UNIVERSITY OF MARYLAND
AGRICULTURAL EXPERIMENT STATION

Advancing Agricultural Horizons Through Research

SIXTY-SEVENTH ANNUAL REPORT
1953-1954

BULLETIN A-81
COLLEGE PARK, MD.
FEBRUARY, 1955

In addition to State and federal funds, the research program of the University of Maryland Agricultural Experiment Station has received support during the year from many public, private and industrial organizations and individuals. It is regretted that space does not permit recognition of all sources of help, but the cooperation of all is herewith gratefully acknowledged.

Visitors will be welcome at all times and will be given every opportunity to inspect the work of the Agricultural Experiment Station in all its departments.

The Bulletins and Reports of the Station will be mailed free of charge to all residents of the State who request them.

Address:

AGRICULTURAL EXPERIMENT STATION
College Park, Maryland
I. C. Haut, *Director*

To the Governor of Maryland, the Board of Regents, and the President of the University of Maryland

I transmit herewith the Sixty-seventh Annual Report of the University of Maryland Agricultural Experiment Station, as established by Act of Congress, March 2, 1887, containing an account of research and experiments conducted during the fiscal year ending June 30, 1954, and a statement of the receipts and disbursements for the same period.

I. C. Haut,
Director

CONTENTS

The project number is given after each progress report. The title of the project and the personnel associated with it can be found listed among the current projects on pages 75-80.

Agricultural Economics and Marketing

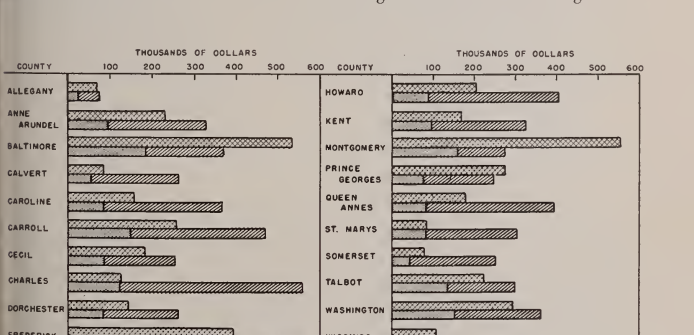
Research in Agricultural Economics and Marketing covers many phases of economics concerning the operation of farms and the economic welfare of farm families. Twenty-two research projects during 1953-54 involved many studies in the two major fields, namely, production economics and marketing. A summary of the progress on some of the projects is given below. Other studies in process of completion include aspects of the marketing of poultry and dairy products, livestock, tobacco, and forest products, as well as investigations in the fields of farm prices, farm credit, farm management, school bus transportation and highway finance.

ECONOMICS

Study Effect of Tax Changes On Farmers' Tax Burden

Any major change in state and local tax systems may have a pronounced effect upon the tax burden of various groups of the state. This study was designed specifically to determine how such recent changes affected the tax burden of farmers.

The five-year rotational assessment system has resulted in unequal current tax liabilities among farmers of adjoining counties. Within the rural-urban fringe areas an additional problem arises because most farms are still operated by persons who depend on income from their farms for a living, whereas the current sales of farms are predominately to buyers who purchase such farms for various reasons at inflated prices. A workable and uniform method of assessing farm real estate is lacking for the rural-urban fringe areas.



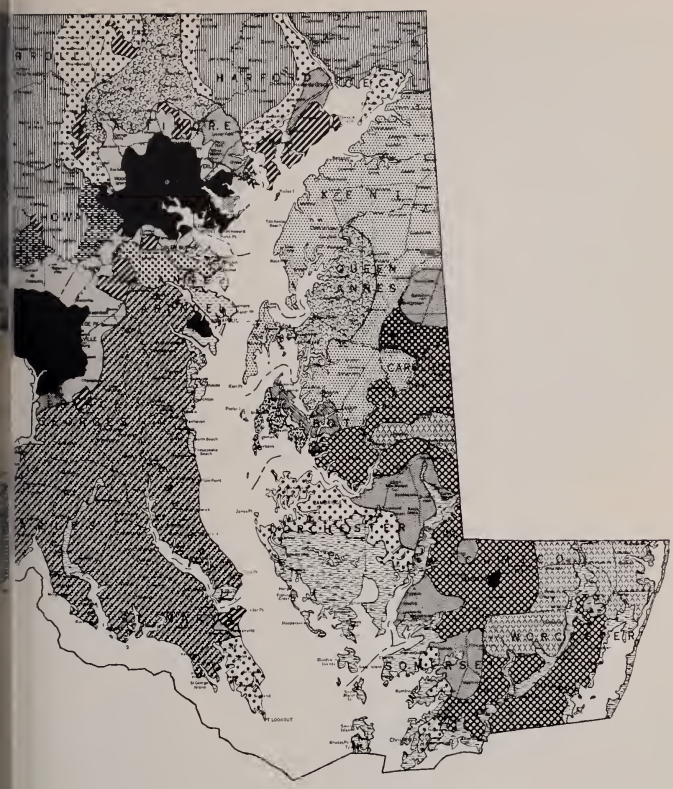
Farm property taxes compared with State Revenue distributions in terms of farm property tax equivalents, 1951-52.

Types-of-farming areas in Maryland, 1951

Changes in the Maryland tax system since 1946 have not resulted in any material changes in farmers' total tax burden in relation to such burdens of non-farmers. State revenue distributions were modified considerably in 1947. These allocations have resulted in considerable property tax relief and have been effective in providing more equal public services without excessive farm property taxes in the various counties. (Project A-19-k)

Type-of-Farming Areas Shift

Maryland has a varied agriculture. Consequently, technical improvement in farming have resulted in shift among the type-of-farming areas in th state. Type-of-farming areas in Mary land were delineated to show repre sentative farm organization patterns Factors which were responsible for th establishment of those areas wer evaluated. The six principal type-of farming areas include: (1) dairyin throughout the Piedmont plateau an the Hagerstown valley, (2) poultr production on the lower Eastern Shor (3) truck crops in parts of the lowe Eastern Shore, (4) tobacco, which pre dominates throughout Southern Mary



and, (5) dairy-cash-grain farming on the upper Eastern Shore, and (6) general farming in Western Maryland.

(Project A-18-ae)

Counties Use Rural Zoning for Orderly Development

Many counties have been experiencing acute planning problems because of (1) rapid and non-planned expansion of rural land uses in agricultural areas, including residential, commercial and industrial uses, (2) the haphazard commercialization of trunk highways, and (3) the pollution of streams from sewage and industrial waste. Many counties are in the process of meeting this problem by enacting zoning ordinances in order to develop the expansion of new land

uses in the county in an orderly fashion. (Project A-32-i)

Insurance Rates Climb As Auto Accidents Increase

Premiums for automobile insurance have increased rapidly in recent years. This has been attributed primarily to the increase in motor vehicle accidents and costs associated with such accidents. During the period from 1943 to 1953 the use of highways in Maryland, measured in terms of traffic counts, increased 190 percent, the consumption of gasoline increased 140 percent, and motor vehicle registrations increased 70 percent. For the same period of time, automobile accidents increased 168 percent and the ratio of accidents to registrations increased 69 percent. Claims on insurance policies in force approximately doubled during this period. Analyses of this study will show whether or not there are significant similarities and differences in factors associated with accident experience of farm and non-farm drivers.

(Project A-19-p)

Volunteer Fire Departments Receive More Tax Support

In recent years the importance and responsibility of volunteer fire companies, together with rapid increases in costs of equipment, etc., have brought about greater tax support to supplement the other income sources of companies. This tax support has enabled volunteer fire companies to perform more effectively and efficiently in rural areas of Maryland.

Volunteer fire departments are rapidly improving their facilities to serve rural communities. In some rural counties the number of volunteer companies has increased by 50 or more percent, and the amount and capacity of

A well-equipped volunteer fire company, adequately supported by the community through taxation and fund-raising activities, is a great asset to rural communities.

fire fighting equipment has doubled, since 1941.

Farms located within a reasonable distance of these fire departments have good protection, and losses resulting from fires may be minimized because of the quick response of a fire department. At the same time, the presence of a fire department in a community may make farmers more fire conscious and may cause them to take proper steps to eliminate fire hazards.

(Project A-19-n)

MARKETING

Egg Huckster Important To Farmer and Housewife

A study made of the operations of 136 hucksters in Maryland indicates that hucksters perform an important function in the marketing of Maryland produced eggs. They not only provide a selling market at the farm for many small egg producers but also provide a buying market at doors of housewives. They supply farm fresh eggs and in many instances other commodities including fruits and vegetables, butter, small livestock and other animal products direct to consumers.

Hucksters usually follow a definite schedule of pick-up and delivery of these farm products. They buy from producers, county stores, cooperatives and other receivers. Fifty percent of the eggs handled by hucksters were bought within a 25 mile radius of Baltimore City, a large market for locally produced eggs. Almost two-thirds of the total volume of eggs handled by hucksters were sold in Baltimore City, 20 percent in New York, 8 percent in Philadelphia, 1½ percent in Washington, D. C., and 4 percent in other markets. Baltimore retail stores received 33 percent of the volume sold, wholesalers 29 percent, housewives 26 percent and hotels, restaurants, etc. 12 percent.

One of the problems which the huckster faces is that of maintaining quality; therefore, he must have good

Egg hucksters provide a buying market at the door for housewives as well as a selling market at the farm for producers.

egg holding facilities and keep the length of holding time to a minimum. It is the general practice of hucksters to buy on Monday and Tuesday of each week; grade and pack on Wednesday and make deliveries near the end of the week. A major portion of the eggs bought have been sized, but relatively few have been both sized and graded. Herein is where the huckster performs an important function in the marketing process.

This study revealed that 50 percent of the eggs handled by hucksters are kept under mechanical refrigeration from the time they are brought in from the farm until they are sold. In other instances where refrigeration is not possible hucksters have made special effort to build ground floor rooms for their egg candling and grading operation. This, of course, has added to the cost of marketing. Data obtained in the study indicate that the cost of transportation amounted to 1.5 cents per dozen, 1.8 cents went for packaging and 1.3 cents per dozen was

required for grading and candling. Transportation, labor and grade loss were major cost items.

(Project A-26-ak)

Survey Shows Institutions Provide Opportunity for Increasing Poultry Sales

A survey of 255 institutions including 110 restaurants, 98 schools, 23 hospitals, 15 colleges and 9 hotels located in two major cities in Maryland, and one in Pennsylvania, shows that the institutional purchases of poultry and poultry products constitute a major market outlet for these commodities. However, results of this study indicate that a larger potential market is in the offing, provided certain factors found to be peculiar to institutional users are taken into consideration by poultry wholesalers and other dealers.

Some of the factors reported in this study are: (1) institutions (unlike retail outlets) tend to buy their poultry and poultry products near the first part of the week rather than at the week-end; (2) in most cases they prefer to buy a lightweight bird in order to make a one-half bird serving; (3) institutions prefer to have their poultry delivered in boxes and to have it fresh packed; (4) hospitals tend to use large quantities of chicken and turkey and frequently broil or cream their poultry for patients. Large quantities of eggs are also used in hospitals; (5) hotels appear to give major emphasis to the price of chicken in relation to other meats; and (6) public schools use large quantities of heavy birds in order to obtain an economical serving for school children.

Institutions use a larger percentage of New York dressed poultry than other markets do. In addition to the purchase of New York dressed and fresh drawn poultry, about 10 percent is bought as ready-to-cook frozen, 10 percent as cut-up fresh and one-half percent as half birds and less than one percent special parts.

It is generally believed by institutional poultry buyers that there has been an increase in chicken purchased by institutions within the past five years. The main reasons for this increase are: (1) an increase in the number being served; (2) a more favorable price relationship with other meats; and (3) customers ordering chicken more frequently. (Project A-26-am)

3/4 of Wheat Sold in July; Only 1/3 on Grade Basis

A recent study of the marketing practices of 242 wheat producers in 15 Maryland counties shows that 74 percent of these farmers sold their wheat in July, or immediately after harvest. However, only 34 percent sold their wheat on a grade basis. Factors contributing to this situation are the lack of storage facilities on farms and a limited use of the government loan program. Only 10 percent of the wheat farmers in this study put their product under government loan in 1952, and 12 percent had farm storage space.

Farmers' knowledge of the market for wheat varied. Almost three-fourths of these farmers get some market information from grain buyers; 62 percent occasionally hear marketing information over the radio; approximately two-thirds read the market information in local newspapers; and smaller percentages get information from county agents, crop reports and other sources. A small number of these grain growers (4 percent) were not aware of the government loan program and 35 percent were unaware of the existence of commercial grading, drying and cleaning services.

(Project A-26-ai)

Md. Canners Have Freight Rate Advantage Over Mid-Western Competitors

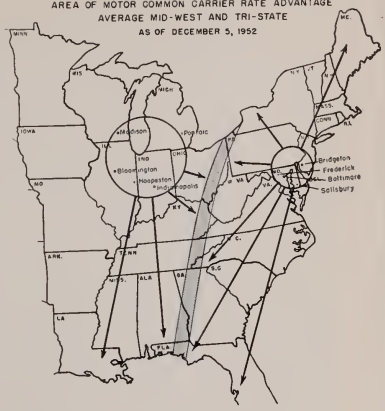
An analysis of freight rates for canned goods shows that Maryland canners have a location advantage

from the standpoint of truck transportation over their mid-western competitors in all of the 17 eastern states extending from Maine to Florida. Since about 40 percent of the United States population lives in this market area, this transportation advantage makes it possible for Maryland canners to compete favorably with canners from the mid-west and greater distances if they maintain equal quality.

However, Maryland canned products, particularly tomatoes, are in competition with superior quality products in many markets. For instance, less than one percent of the canned tomatoes manufactured in Maryland were sold as fancy grade and more than two-thirds were sold as standard grade. In contrast, almost 90 percent of the tomato juice and about half of the corn packed in Maryland was sold as fancy grade.

During the three year study, 51 percent of all sales of Maryland canned products were made under the buyer's label, and only 38 percent carried the packer's label.

The results of this study indicate that Maryland canners should undertake a program of improving the quality of their products, particularly in certain lines, and they should build a quality reputation under their own labels. This appears to be far preferable to the current procedure of selling a majority of relatively low standard products under the buyers' and brokers' labels. (A-26-ab)



Tri-state canners have favorable motor-carrier freight rates to market areas along the East Coast (east of the dotted band on the above map), which gives them a competitive advantage in transportation costs over canners from the mid-west.

Agricultural Education

Young and Adult Farmer Courses Show Increase During Past Year

The number of courses conducted with young and adult farmers increased during the past year in Maryland, at least partially as a result of the Experiment Station study of the possibilities of such work. The results of the study showed that most farmers in selected communities desired opportunities to engage in such programs. The major deterrents were a lack of teachers and teacher time, as well as a need to stimulate the developments of such programs on the part of school administrators. The latter is being alleviated and a greater increase is expected in the number of programs during the coming year, in spite of a continued scarcity of teachers and teacher time.

As programs for young farmers and adult (established) farmers are added to an already strong program for future farmers (high school students) in Maryland a complete program of systematic instruction for farmers is being established. This is in accordance with the examples set in many other states and fulfills the intent for agricultural education as expressed in the Smith-Hughes and George-Barden Federal Vocational Acts. (Project T-1)

How Young Farmers Become Established

A survey of 50 young farmers in Charles, Frederick and Talbot counties revealed some pertinent data concerning the status of young men in farming. Almost half (45 percent) were farming in partnership, mostly with their fathers. The percentage farming in this status was almost the same in all three counties, (Charles—23 or 46 percent; Frederick—23, or 46 percent; Talbot—22 or 44 percent), probably indicating this type of operation prevails throughout the State. In Charles county the majority of the remaining group (18 or 36 percent) were full owners, in Frederick county the only other dominant status was cash tenants (18 or 36 percent), while the number of share tenants equaled the number of partnerships (22 or 44 percent) in Talbot county.

Only men who had entered farming since World War II and who were under 40 years of age were included in the study. Excluded were young men who had been in partnership for less than two years and those who were in farming categories such as farm managers, hired workers or sons at home working under indefinite arrangements.

The pattern each young man followed in entering farming was recorded, but no dominant pattern was discovered. About half of the 68 young men in partnerships had entered farming as partners, while the share tenants, cash tenants and owners followed many and diverse patterns in becoming established.

The young men showed the greatest average annual increase in net worth ($2,262) while in the cash tenant status, followed closely by the years in full owner status ($1,915). The average annual increase in net worth for years spent in partnerships, in share tenancy, as hired workers of various sorts and in non-farming status was much lower. (Project T-2)

For Mow Curing Chopped Hay is Best

Chopped hay can be cured in the mow more efficiently than long or baled hay. Less labor is used, higher quality is obtained and maximum use is made of available mow storage space at lower drying costs. This does not mean that baled hay cannot be dried efficiently but baled hay is not as good as chopped when cured under identical conditions. Long hay is easy to cure, but a large amount of labor is required and more storage space is needed.

Progressive and successful farmers all over the state have accepted artificial curing of hay as one of the most profitable methods of increasing production while at the same time reducing feed costs. Dairy farmers with 40-60 cow herds have reduced grain costs by as much as $1,500 in one season. This repaid the entire cost of the system in one year, including the costs of operation. Mow curing hay is definitely recommended for all farmers producing 60 or more tons of hay per season. (Project R-14)

Produce Loader Speeds Harvest From 30 to 100%

A 30 foot self-propelled conveyor has been developed by station workers to assist truck farmers in the harvesting of low growing crops which at present are harvested almost entirely by hand. This machine has been named a "Produce Loader." The chief function of the machine is the elimination of basket handling in the field by individuals harvesting the crop. Pickers place the crop on the conveyor

Research agricultural engineer explains to Washington county farmers how to check moisture in damp hay and determine when it is ready to be chopped and placed on the mow hay drier. During the demonstration a meter (shown on the ground in center) was used to check on the accuracy of hand judging. The estimate was within 2 - 3% of the meter reading in all cases.

Through the use of the experimental produce loader the above crew picked 50% more tomatoes than would have been harvested by hand in the same period of time.

belt in front of them. The belt carries the vegetables to one end where they drop into the baskets. At this end an extra man is required, usually the foreman, who controls the machine travel, replaces full baskets with empties, and controls the quality of the pick.

When used on tomatoes, the chief test this past season, the machine covered five six-foot rows, or six five-foot rows, in each pass across the field. Since the machine is pivoted on one wheel in turning, a pick-up row is necessary every ten or twelve rows in tomatoes. In hand picking a pick-up row is used every five or six rows. Thus the loader eliminates much damage to the crop since only one half as many pick-up rows are necessary. Damage caused by the wheels of the machine and the machine passing over the crop was negligible. Increases in harvesting rate varied from 30 to 100 percent, depending on the crews used on the machine. The loader was tested on cucumbers with equally satisfactory results.

Some changes are necessary before this machine will be released either for production by a manufacturer or for building from plans by farmers. The machine is simple in construction. Any machine shop can build it. Changes have been made on the machine and an entirely new loader with a different drive principle has been built. Both machines will be operated in the 1954 harvest. (Project R-15)

Self-Propelled Spearing Machine Reduces Labor In Tobacco Harvest

During the 1953-54 season the tobacco spearing machine recently developed under this project was operated in the field and very good results were obtained. Test runs indicated that a two man crew should spear, on the average, three sticks a minute. An inexperienced crew can learn to operate the machine very efficiently after a few minutes' practice. Tobacco speared by the machine was hung much easier and faster in the barn than hand speared tobacco. This is attributable to the fact that all the tobacco stalks were equally spaced on the sticks. Damage done to the tobacco speared by the machine was about the same as by hand.

(Project R-11-c)

Unheated Forced Air Used to Cure Tobacco

Tests were continued during the season on the use of supplemental heat and forced air for curing. Very good results were obtained in the cinder

block curing barn using forced natural air for curing. The fans were controlled by a humidistat which operated the fans when the relative humidity was below 85 percent. Approximately 8,000 cubic feet of air per minute per acre was used. No tests were made using supplemental heat due to ideal natural curing conditions.

(Project R-11-d)

Tobacco Conditioned In Underground Rooms

Tests were conducted on the use of underground and half-underground rooms to bring and hold tobacco in order for stripping. These underground chambers were built of standard concrete block with dirt floors. The underground chamber brought tobacco in condition faster than the half-underground chamber. The latter, however, did a good job of bringing into condition and holding the tobacco in condition for stripping. The sticks of tobacco were hung approximately five inches apart. Tests are under way on the effect of different temperatures and humidities on cured tobacco. (Project R-11-e)

Shelled Corn Can Be Dried In Bin With Unheated Air

Work to determine the possibilities and limits of drying shelled corn with unheated air was started during the year.

Corn at an initial moisture content of 27 percent was dried to 13 percent without mold development in about two weeks at depths up to 6′ 11″ when air was supplied at a pressure of two inches of water and the blower was operated continuously.

When the blower was controlled by humidistat, set so it would run only when the relative humidity was below 75 percent, slight mold was found in the upper layers of bins 5′ 7″ and 6′ 11″ deep but none was found in a bin 4′ 7″ deep.

Continuous operation of the blower provided slightly faster drying than humidistat controlled operation but did not dry to as low a moisture content. The difference in drying rate alone would not seem to be sufficient to account for the difference in mold development. (Project R-12)

Use of artificial light for stripping tobacco, showing lights properly located and the men stripping from tables and using stools to sit on. This method is less tiring than working from the floor.

An important part of the research program in Agronomy is conducting research studies at a number of locations in the State. Having research at several locations has some important advantages, such as:

1. *Varieties and strains tested over a range of conditions can be more safely recommended for farm use.*

2. *In developing lime and fertilizer recommendations, soil types often have an important effect. Differences in soil type can only be determined by research at the locations where the soil types exist.*

3. *Some of the problems that are studied are the result of conditions as they exist on farms in the State. For example, certain weed problems are not found on the experimental farms but are serious in some areas of the State. In this case it is necessary to do the research at the location where the problem exists.*

4. *Outlying research helps Maryland farmers become better informed as to the methods that are used by research workers in answering problems and creating recommendations.*

5. *In addition to the tendency for somewhat more rapid application of research findings, outlying plots have been worthwhile because farmers have been closer to the research work and often express ideas that help to guide the future research program.*

Successful conduct of these outlying trials is made possible through the fine cooperation of farmers throughout the State.

GRAIN CROPS

Study Soybean Varieties; Rate and Date of Planting

For the first time agronomists of the Maryland Agricultural Experiment Station conducted variety, rate and date of planting studies with soybeans. This work is in cooperation with the Field Crop Research Branch, Section of Forage Crops and Diseases, U. S. Department of Agriculture and is coordinated with studies that have been conducted at the Beltsville Station.

Soybeans at Upper Marlboro where 21 varieties were compared. All planted on May 26; picture taken on September 27. Note early varieties ready for combining in the foreground. Later varieties in the background will need 6 weeks longer to mature.

In this study at Beltsville and Upper Marlboro it was found that long-season soybeans, such as Ogden and Lee excelled in yield only at the very early dates of planting. These dates were earlier than are considered safe for general planting of soybeans in this area of the State. The Perry variety yielded well at all dates of planting.

In a factorial study including date of planting, variety, width between rows, and rate of planting at Upper Marlboro, greater lodging was found as the rate of seeding increased. Yields definitely decreased with increased rate of seeding. Perry was the highest yielding variety at row widths of 2 feet.

Variety testing at Beltsville, Upper Marlboro, Trappe, and Snow Hill showed that the Clark, Lincoln, Perry and Ogden varieties were most productive and resistant to lodging. The Adams and Chief varieties were deleted from the variety recommendations for Maryland, being replaced by the Clark variety. (Project B-43)

Seek Successful Method of Planting Cover Crops Between Corn Rows

Maryland farmers have been interested in finding a successful way to establish cover crops in standing corn. One way that may aid is the wide spacing of corn rows. In a test established at the Plant Research Farm in 1953, corn was grown with spacings 40″ between rows and planting set at 11,412 plants per acre. A second method used 40″ spacing between rows but omitted each third row, leaving a 80-inch spacing in which to establish cover crops. Planting was adjusted to give approximately 11,000 plants per acre. A third method was the use of 40-inch spacing between rows at the thicker rate of planting in the row, resulting in 16,466 plants per acre. During the 1953 growing season, leaving every third row blank resulted in better establishment of the cover crop.

(Project B-30)

Wide spacing of corn rows permits better growth of inter-seeded cover crops, but usually results in some reduction in corn yield.

Rate Sweet Corn For Drought and Wilt Resistance

Very dry weather during the 1953 growing season, and the presence of bacterial wilt offered a good opportunity for rating 56 sweet corn hybrids for vigor of growth and resistance to bacterial wilt. Following is a summary of the response of a few of the more important white and yellow sweet corn hybrids to these factors.

(Project B-44)

Response of Sweet Corn Hybrids to Conditions of Drought and Bacterial Wilt Infection. 1953.

Hybrid	*Days to Harvest*	*Tons Per A.*	*Ears Per 100 Plants*	*Plants Killed by Wilt. %*
White Hybrids				
Peoria	84	2.6	48	2
Hybrid 3x33	82	2.1	44	4
Ill. 14x11	82	2.3	47	0
Co. Gent. Ill. 13	83	1.8	36	2
Yellow Hybrids				
Penndale	73	1.1	32	14
Hoosier Gold	75	1.7	28	18
Seneca Chief	77	2.2	64	4
Golden Cross. B.(1)	78	1.2	24	58
Golden Cross. B.(2)	78	1.2	20	65
Golden Cross. B.(3)	78	.7	17	73
Ioana	79	2.4	51	16
Victory Golden	79	2.1	44	14
Tendermost	79	1.7	37	19
Iochief	79	2.2	68	1
Sweetangold	79	2.7	62	4
Golden Hyb. 2057	82	2.7	65	0

Test Wheat Varieties Under High Fertility Conditions

A number of Maryland farmers are using longer rotations with more years of alfalfa or ladino clover for hay, pasture, or grass silage. In these rotations somewhat higher applications of fertilizer and manure are used than has been the general practice in field crops in Maryland. In addition, these legumes often leave a much higher level of nitrogen in the soil than is found with shorter rotations. The Maryland Agricultural Experiment Station has been studying five leading wheat varieties to learn their comparative value under these conditions of high available fertility in the soil.

The varieties Atlas 50, Pennoll, Thorne, Vigo, and Tayland were compared during 1953 at several levels of fertilizer application with the check or base level supplying 12 pounds of nitrogen, 48 pounds of P_2O_5 and 48 pounds of K_2O at the time of seeding the wheat in the fall, followed by 25 pounds of nitrogen top dressed in the spring. Varying levels of phosphorus, up to 480 pounds of P_2O_5 per acre, and of K_2O up to 840 pounds per acre were applied at the time of seeding the wheat, and up to 75 pounds of nitrogen was applied as a spring top dressing.

Atlas 50 appeared to respond better to high fertility levels than any of the other varieties tested; however, no yield exceeded 35 bushels per acre and none of the increases in yield above those obtained at the base level of fertilization were profitable. All varieties lodged at the highest rate of nitrogen applied, with Atlas 50 showing the least loding. (Project B-66-g)

Tayland, New Wheat Variety, Released After 6 Year Test

A cross between the Maryland variety Leapland and the South American variety Fronteira, made by Mr. J. W. Taylor of the U. S. Department of Agriculture and placed in the Maryland trials as experimental selection Y-2381, has been named the Tayland variety and released for use of Maryland farmers. In six years of testing throughout the State, this variety has been found superior to currently recommended varieties. Much of its superiority lies in the fact that it is resistent to a number of leaf diseases that tend to reduce wheat yields in Maryland in some seasons.

In cooperation with the Seed Certification Board, stocks of this seed have been developed to the point where many farmers could purchase certified seed of the variety for planting in the fall of 1954. During 1953 the Tayland variety made the top yield in 5 of the 6 locations throughout the State where it was compared with established varieties. (Project B-66)

Complete Rye Study

Completion of fourteen years' testing of commercial rye varieties on various soils, and with several fertilizer mixtures has led to the following conclusions:

1. The southern varieties Abruzzi and Balbo consistently yielded about 4 bushels more per acre of grain than northern varieties such as Rosen, Imperial and Cornell 76, while straw yields have been about equal for southern and northern varieties.
2. Under low fertility conditions, with an application of 400 lbs. of 2-12-6 per acre, southern rye varieties have outyielded wheat by about 4 bushels per acre. On soils low in nitrogen, spring top dressing has increased rye yields but have been accompanied by much lodging.

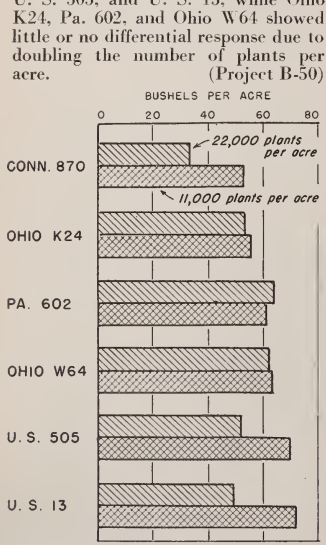
Farmers inspecting the Tayland variety in trials on the Willis Farm near Trappe.

3. Rye grain quality, as measured by kernel plumpness, has been poor for all varieties.
4. Strains recently introduced from Germany, Tetra Petkus and Von Pumker's, give some hope for better grain quality.

(Project B-57)

Corn Hybrids Vary in Performance When Thickly Planted in Dry Season

The results of past years' research work with hybrid corn in Maryland lends further support to the opinion that the optimum planting rate depends upon growth conditions during the season and the particular corn hybrid selected. In the following figure it is noted that 22,000 plants per acre was too thick for maximum yields for all of the hybrids under trial. The greatest reduction in yield was found with hybrids Conn. 870, U. S. 505, and U. S. 13, while Ohio K24, Pa. 602, and Ohio W64 showed little or no differential response due to doubling the number of plants per acre. (Project B-50)



Response to thick planting in a dry season, 1953.

Check Yields of Oats and Barley Varieties

Kenbar, Hudson and Wong have continued to be the higher yielding varieties of barley in Maryland tests. For two consecutive years in these tests Kenbar and Hudson have given better yield and grain quality than Wong, the standard Maryland variety.

Arlington, a new winter oat variety, has yielded on a level with Lee for a period of 4 years and is now being recommended for use in Maryland.

Among the spring oat varieties, Clinton 59, Andrew, and Mindo have given good yields and have been similar in performance for three years.

(Project B-67)

PASTURE AND HAY CROPS

Select Superior Strains Of Orchard Grass for Test

The principal emphasis in the orchard grass breeding program has been the selection of late maturing strains that will be useful with alfalfa for hay. Superior late maturing strains have been selected and are now being tested more extensively to determine how well they grow in association with alfalfa, and the yields that may be obtained from the mixtures of these late strains with alfalfa.

As in any preceding program with similar plants, a number of years of work will be needed before the best of these strains can be identified and released for farm use. (Project B-56-i)

New Red Glover Strains Show Vigor and Resistance

Ten superior lines of red clover developed by Station research have been selected for further testing in Maryland. These have been selected primarily for vigor and resistance to

Southern anthracnose. These lines are being placed in red clover tests throughout the State to compare them with the better varieties now available. (Project B-56-a)

Best Forage Varieties Checked at Several Locations in State

Continued testing of forage varieties and strains is important so that Maryland seedsmen can stock the kinds that are best for use in Maryland, and Maryland farmers can get high yields from their forage crops. It is necessary to conduct these tests at several locations to determine the adaptation of varieties to various soil and climatic conditions. At present, tests of this type are under way with ladino clover, lespedeza, orchard grass, tall fescue, alfalfa, and Bermuda grass.

Important findings of the past year are that the Williamsburg and Narragansett varieties of alfalfa continue to be superior to others tested. The Climax variety of lespedeza has proved to be the most productive in tests on the Eastern Shore of Maryland. The Coastal variety of Bermuda grass has proved to be more vigorous in growth but less winter hardy than the Midland variety of Bermuda grass.

(Project B-56-l)

Select Superior Ladino Types; Will Begin Crossbreeding Work

One phase of the program to develop superior ladino clover breeding material was completed this year. Clones of ladino clover superior both in persistence and yield to the ladino generally used in the State were selected. Among these selections were some collected from pasture fields throughout the State where ladino has been maintained for several years. In the next phase of this work it is planned to test the seed from crosses of these superior individual plants, looking toward the establishment of a new variety.

(Project B-56-g—NE-10)

Visitors viewing ladino clover plants in the breeding nursery at the Plant Research Farm.

Environment Study Shows Why Forage Crops Fail or Yield Poorly

In cooperation with several Northeastern states, a study of the more important environmental factors affecting growth of forage crops in the field was completed. It was found that moisture, temperature, and light were among the factors that had a critical effect on survival and yield of several forage crops.

Although annual precipitation for each of the past three seasons was found to be near the long-time average, periods of drought occurred during each growing season. Whenever two weeks or more elapsed between rains durng the summer months, adequate soil moisture was not available for optimum crop growth.

Depetion of soil moisture and subsequent sparse fall growth were found to be closely related to the loss of ladino clover stands during the winter and early spring months.

Uniformity of plant cover was found to be more important than the total amount of cover in reducing heaving of plants.

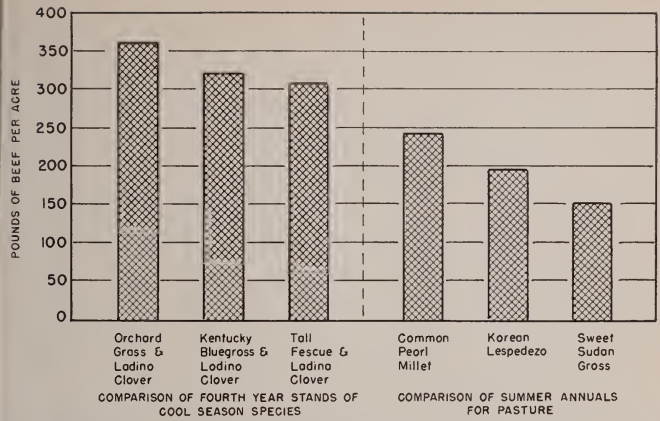
A 2-foot growth of orchard grass was found to reduce light readings from approximately 10,000 foot candles at the top of this growth to less than 100 foot candles near the soil surface. This helps to explain why the use of orchard grass as a hay crop often eliminates a companion crop of ladino clover.

The total time of a particular temperature occurring in a day was found to be more important than the range between maximum and minimum temperatures for that day with regard to early spring growth. (Project B-56-k)

Pearl Millet Shows Promise As Hot, Dry Weather Pasture

In continuing grazing trials, gains beef cattle made on three leading cool season pasture mixtures were com-

Yearling Hereford steers grazing on research plots of common pearl millet. Picture taken October 7, 1953.



Comparison of summer annuals and cool season species, in grazing trials, 1953, Tobacco Experimental Farm, Upper Marlboro.

pared with gains from three important warm season annuals. The chart above the comparison of pounds gained per acre for the cool season mixtures.

This year was the fourth consecutive year these mixtures had been grazed following establishment. Beef gains were lower than in previous years.

Kentucky bluegrass and white clover make excellent growth and good beef yields in the spring but are not productive in the summer.

While this may in part have been due to seasonal variations, it is in line with other trials which show that tall growing mixtures, orchard grass-ladino and tall fescue-ladino, need to be reestablished every three or four years to maintain high yields. Beef gains from Kentucky bluegrass and white clover more nearly approached the tall growing mixtures this year than in the first three years.

The comparison of warm season annuals shows that the newcomer to Maryland agriculture, common pearl millet, was the most productive in this first year comparison. This is in agreement with small trials in which the yield of forage had been determined by clipping. It indicates need for further work to evaluate this and other millets which may be capable of providing adequate pasture during the hot, dry summer months, when other types of pasture are usually short.

(Project B-56-j)

Regional Forage Variety And Strain Test Completed

In cooperation with other Northeastern Agricultural Experiment Stations the Maryland Station conducted a test of leading forage crop species and the more important strains within these species. These tests were conducted at 7 locations in the Northeast and results have been interpreted on a regional basis to more clearly define areas of adaptation of various strains and varieties.

From the Maryland work, Williamsburg and Narragansett alfalfa, Kenland and Pennscott red clover, Pilgrim ladino clover, Beltsville orchard grass and Achenbach and Fischer smooth brome grass were found to be superior. All varieties of birdsfoot trefoil and timothy were generally unsatisfactory in persistence and yield.

For the region as a whole, it was found that the area of adaptation of a superior forage variety will usually extend over several states.

(Project B-56-f—NE-10)

SOILS

Legume Cover Crops Raise Yield, Lower Quality of Tobacco in 4 Year Test

The yield and quality of tobacco grown during each of the past four years has been materially affected by the type of winter cover crop used. Uniform annual fertilization of 1,000 pounds per acre of 4-8-12 for the tobacco crop was followed. Where winter covers such as wheat, ryegrass or volunteer weeds were used, average 4-year tobacco yields were less than 1,100 pounds per acre. Increases in yield were obtained from crimson clover and combinations of vetch with various grasses or small grains. A maximum of 1,552 pounds per acre was obtained with vetch alone.

The high yields obtained from the use of vetch covers were accompanied by a drastic loss in quality because of the increase in the amount of dark tobacco. This effect was cumulative and was reflected in a 10-cent decrease in price per pound of the tobacco grown after vetch.

This work is continuing with emphasis on the effect of the composition and quantity of the cover crops on the growth, quality and composition of Maryland tobacco. A fellowship grant from the Maryland Tobacco Improvement Foundation materially assists this project. (Project B-68)

Alfalfa Stands and Yields Improved by Availability of Phosphorus and Potash

The continuation of a study of alfalfa fertility needs on several soil types in Maryland shows that there is considerable difference in the initial fertility on various soils due to previous treatment. It has been found that on a few soils adequate phosphorus and potash are available for good yields of alfalfa where the general practice on the farm has been liberal fertilization. On other soils where little fertility has been added in past years, response to phosphorus and potash applications is

apparent in the establishment and in the first crops of alfalfa that are harvested. As the study progresses it will aid in determining the optimum alfalfa yields that may be obtained on various soils in the State and, also, the amount of potash that various soil types release. (Project 0-51)

Are Soil Tests Index of Phosphate Availability?

A number of the important soil types from throughout Maryland have been collected for further determining the value of soil tests as an index of phosphate availability to plants. Alfalfa is being grown on these soils at the Plant Research Farm and preparation is being made to analyze the soil and the plants by various chemical procedures.

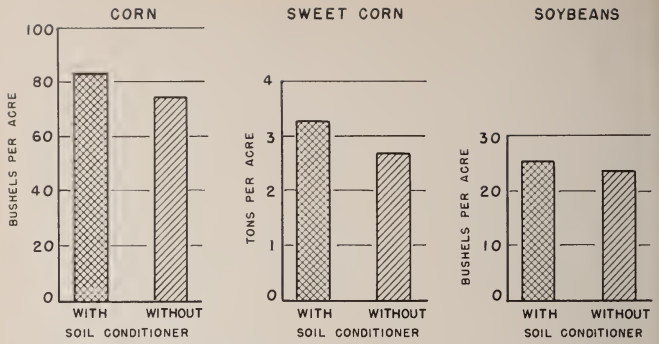
Studies are being continued to determine the comparative value of various phosphate materials for the growing of corn, wheat, and red clover. (Projects 0-52 and 0-45-b)

Improving Soil Structure Raises Crop Yields

Continued studies of the effect of crop rotation on the physical condition of soil are helping to classify the crop rotations that are in general use and those which appear to have promise as to the effect on soil structure. Reference in this report to good physical condition of the soil, good soil structure, or desirable soil aggregation indicates the tendency of the soil to stay loose and to be in good tilth, as compared to the tendency for soil to crust or to become packed.

Out of the past two years of study, on a Beltsville silt loam soil near College Park, has come the realization that changes in aggregation of soil particles occur rapidly and that the problem of maintaining good soil structure needs every-day action on the farm. To date these studies indicate that the more we can reduce plowing and cultivation while maintaining satisfactory yields, the better we can maintain or improve soil aggregation.

Alfalfa grown in containers at the plant Research Farm in preparation for study of soil tests indicating available phosphorus in different soil types and at different levels of application to the soil.



Two year average yields on Beltsville silt loam, Plant Research Farm, near College Park.

For example, a continuous wheat program, using Korean lespedeza as a green manure, and with the soil disked only once each year just before planting the wheat, has been found excellent for maintaining soil aggregation.

In order to get a direct and rapid method of determining the effect of soil aggregation on crop yields, these rotation plots have been split so that a half of each plot has been treated with a soil conditioner and the other half is left without treatment. Average yields for the past two years for corn, sweet corn, and soybeans are shown in the graph. Adequate use of nitrogen, phosphorus and potash on all of these plots produced yields above the State averages. When a soil conditioner was used to improve soil aggregation, yields of these three crops were improved. Soil conditioners at the present time are not practical for farm use because of cost, but finding that better soil aggregation improves crop yield is important as we strive toward maximum yields on Maryland farms.

In addition to studies of the effect of soil aggregation on crop yields, a series of field and laboratory studies are under way to determine the sources of variability in soil aggregation and the relative importance of some of the factors that affect aggregation. These studies, fundamental in nature, will aid in further explaining the results that are obtained in the rotation study and in other soil structure problems.

(Projects 0-53—NE-11 and B-65)

Minerals Clue to Soil Formation and Capability

A complete analysis of the minerals found in a Chester silt loam soil profile was made during the past year. Additional profiles have been collected and prepared for study. The following minerals were found in decreasing order of abundance in the Chester soil: Quartz, muscovite, biotite, ilmonite, magnetite, tourmaline, epidote, titanite, kyanite and horn blends.

An interesting finding in the soils of the Piedmont region, which have so far been studied, is the indication that these soils are formed from transported material. Apparently these materials were moved to their present location by wind. They are found from the surface down to 26 inches in the soil. Below this the subsoil is formed of residual materials. If further study confirms this finding, this work will be of great assistance in helping to more accurately classify the soils for various land uses. (Project 0-54)

By studying minerals found in Maryland soils, soils scientists are able to more accurately classify soils for land use capability.

Higher Fertilization Rates Increase Late Potato Yields

During the past four years a study of late potato fertilization in Garrett County has shown that somewhat higher rates of fertilization than are now in general use will give increased potato yields and also aid in the growing of better grain and hay crops that are used in rotation with potatoes. Following are the 4-year average yields determined during this study:

Summary of 4-year Fertility tests with Late Potatoes Garrett County, Maryland

Nitrogen in Spray	3–12–12	*Nitrogen in Neutral Carrier*	0–6–20	0–6–0	0–0–20	*Average Yield*	*Increased Yield*	
							Over Preceding Treatment	*Over Base Treatment*
Fertilizer Applications in Pounds Per Acre						Bushels Per Acre		
88						245		
88	600					294	49	49
88	600	150				342	48	98
88	600	150	1,000			378	36	134
88	600	250	1,000			385	7	141
88	600	250	2,000			367	−18	123
			Increase Over Base Treatment					
88	600					294		
88	600			1,000		310		16
88	600				1,000	313		19
88	600		1,000			345		51

As a result of this research and previous work on late potatoes in western Maryland, the recommendations for fertilization of late potatoes have been increased. These recommendations have been printed and distributed to potato growers in that area. (Project 0-28-b)

TOBACCO

Heavier Fertilization Permits Increase in Tobacco Plant Numbers

During three years of a continuing test, results indicate that quantity of fertilizer is more important than method of application, while the density of planting is second only to fertilizer rate in importance.

A low rate of fertilization, 750 pounds per acre of 4-8-12, was a limiting factor of sufficient importance to overshadow all variations in plant population or placement. At fertilizer rates of 1,500 and 2,000 pounds per acre, broadcast application was equal to, or better than, band or row application at planting time. Broadcasting was also decidedly better than delayed sidedressing of all the fertilizer.

When enough fertilizer is used, it pays to step up planting rates. With rows 40 inches apart, a spacing of 22 inches in the row was definitely better than 32 inches. If moisture is favorable, a 16-inch spacing, or 8,700 plants per acre, showed further gains, but under droughty conditions, the plant competition may become too severe for maximum returns. (Project B-60)

18-Inch Tobacco Spacing Yields Highest Net Return

The trend in cigarette producing areas has been toward more intensive production on restricted acreages. One important step in intensifying production has been the increase in number of plants per acre. A study begun in 1949 of various spacings in Maryland tobacco was recently concluded. In the latter part of this test the principal comparison was between 36″ and 42″ between rows of tobacco and spacings within the row of 12″, 18″, 24″ and 30″ between the plants. This gave extremes from approximately 5,000 plants per acre to 14,500 plants per acre. The tobacco was grown in continuous culture with wheat as a cover crop and a uniform fertilization of 1,000 pounds per acre of 4-8-12 was applied in the row for the tobacco each year.

Yield and quality increased as the number of plants per acre increased. With fewer plants per acre the individual plants were larger, as would be expected, but due to the greater nitrogen supply per plant there was a higher proportion of dark tobacco which was undesirable. With close spacing, competition for light tended to produce a taller, more slender plant with higher leaf number. Due to a combination of competition for light and nitrogen, the cured leaves were lighter in color with the closer spacing and a higher proportion of the crop fell within the more favorable qualities. On Monmouth loamy fine sand, a summary of the five years of work shows that the 18″ interval in either 36″ or 42″ spacing between rows produced the highest net return despite higher cost for seedlings and increased field and stripping labor. (Project B-62)

Improved Varieties Soon To Be Released

In cooperation with the Botany Department of the University of Maryland, and with the Field Crops Research Branch of the U. S. Department of Agriculture, improved strains of Maryland tobacco having combined resistance to black root rot, wildfire, mosaic and Fusarium wilt have been tested at the University of Maryland Tobacco Research Farm during the past four seasons. From some 100 original strains, four lines of outstanding merit have been selected. These four lines, which as yet are unnamed,

have produced yields and acre values which are higher than the Robinson and nearly equal to the Wilson varieties, which are in use in Southern Maryland at the present time. In these same studies it was noted that new lines were equal or superior to the Robinson and Wilson varieties in leaf type, growth habit, color, texture, burn, aroma and alkaloidal content. These lines also showed complete resistance to the diseases mentioned. Final field testing on the experimental farm and in cooperation with Southern Maryland farmers, and increase in seed supply is being undertaken during 1954. This will be followed by tests by cigarette manufacturers as to smoking quality and chemical composition before the lines are named and released. (Project J-89)

Superphosphate Used With Cyanamid Improves Tobacco Plant Bed Stands

Granular calcium cyanamid has been used extensively in the Southern Maryland tobacco producing areas for treatment of plant beds to reduce weeds. Research elsewhere has indicated that better stands of tobacco plants and less residual toxicity from the calcium cyanamid is found when heavy rates of phosphate fertilizers are used in conjunction with the calcium cyanamid treatments. The following example from the past year's research at the University of Maryland Tobacco Experimental Farm indicates that this same result is to be found in Maryland:

Treatment	*Plants Pulled Per 100 Sq. Yds.*
Calcium cyanamid at 1.5–2.0 pounds per sq. yd. No phosphate	7,200
Calcium cyanamid at 1.5–2.0 pounds per sq. yd., plus 1 pound 20% superphosphate, applied in the fall	9,700
Calcium cyanamid at 1.5–2.0 pounds per sq. yd., plus 1 pound 20% superphosphate applied in the spring	10,600

Further studies are needed to determine whether the addition of superphosphate should become a standard recommendation in Maryland.
(Project B-59)

Tobacco Variety Comparison Shows Interesting Differences

During the four years starting in 1950, a variety test of Maryland tobacco was conducted cooperatively by the Experiment Station and the Maryland Tobacco Improvement Foundation. The performance of five outstanding named varieties is shown in the table below:

Yield and Acre Value Maryland Tobacco Varieties

Variety	*(Three year average 1950–1952) Yield, lbs./A*	*Value, $/A.*
Posey	1289	813
Wilson	1294	812
Keller	1354	783
Catterton	1157	718
Robinson	1206	666

The three broadleaf varieties, Posey, Wilson and Keller performed in very similar fashion, with no real difference in yield. Dollar values were also closely grouped, except for lower values for the Keller variety, due to darker upper leaves, which in turn was associated with slower maturity. Catterton, long a favorite with the farmer because of its resistance to black root rot, produced less tobacco, but the quality was enhanced because of the desirable reddish brown color of the leaves. Robinson is representative of the medium broadleaf type, and may range in leaf shape from quite narrow to rather broad depending on abundance of moisture. Its principal asset is resistance to Fusarium wilt, a disease widely found in Maryland but seldom of major importance due to its erratic response to growing conditions.
(Project B-64)

SEED INSPECTION

Busy Year For Seed Testing Lab

Maryland farmers and seedsmen submitted 2,899 samples of seed during the past year for examination by the State Laboratory. The reports from the laboratory on germination, purity, and weed content aided in the correct labeling of seeds offered for sale in the State and helped farmers to determine whether the seed that they submitted was valuable for use on their farms.

Approximately 400 samples of tobacco seed were cleaned for the farmers of Southern Maryland and germination tests were made so that this seed could be planted at the proper rate for best development of tobacco plants.

In the spring of 1954 retail seed distribution points throughout the State were visited and 400 samples of seed were collected in order to gain information on the accuracy with which these seeds were labeled. Laboratory examination of these samples showed that by far the largest percentage were properly labeled. In the cases where improper labeling was found, the vendors were so notified.

In addition to the laboratory examination of samples collected, field plots were established to study the varietal purity of seed samples of oats, barley, wheat, rye, soybeans, alfalfa, red clover, and birdsfoot trefoil. (Projects N-7, N-8, N-9)

WEED CONTROL

Pre-Emergence Weedkillers Plus Bandseeding Show Future Promise

In close association with the study of the use of chemicals after seeding of alfalfa is a study of band seeding and fertilizer placement with the application of various chemicals between the bands at the time of seeding. Research at the Ohio Agricultural Experiment Station has shown that placing the seed in rows over fertilizer can help to get alfalfa seedlings established more rapidly and aid these seedlings in competing with weeds. This has been popularly called band seeding. Using this information and adding the thought of controlling weeds between rows, seedings were made at four locations in Maryland during the spring of 1953 and at three locations in the fall of 1953.

Results of this first year of work show:

1. Row seedings were superior to broadcast seedings when alfalfa was used at the rates of 8 and 16 pounds per acre. In each case where seed was placed in the row, fertilizer was also placed in the row.
2. Use of a special grade of calcium cyanamid which was finely pulverized, appeared promising for control of weeds between rows.
3. Use of a combination of MCP and CIPC also appeared promising for reducing weeds between rows.
4. There is need for development of machinery to better apply these chemicals in order to gain weed control advantages without reducing the stands of alfalfa.

(Project B-58-c)

CIPC Proved Most Effective To Control Chickweed in New & Old Alfalfa Stands

In the third year of research in Maryland with the use of CIPC [isopropyl N-(3-chlorophenyl) carbamate] this chemical has been proved to be the most effective herbicide yet tried for control of chickweed in seedling or established alfalfa stands. This has led to recommendations that one to two pounds of active CIPC be used during late fall or winter following late summer seeding of alfalfa where chickweed proves competitive. This re-

search has shown that chickweed is widespread but that in many fields it does not make sufficient growth to be competitive; therefore, based on the research, treating with CIPC is not recommended unless the chickweed outgrows the seedling alfalfa plants and tends to form a mat over these plants.

The one drawback that remains to the use of CIPC is the tendency for this chemical to kill grasses that are seeded in association with alfalfa. Where a farmer hopes to maintain a grass-alfalfa combination, the use of DNOSBP (4, 6 dinitro-ortho-secondary-butyl phenol) is recommended, based on previous research.

Further research was conducted with the use of a combination of CIPC and MCP (2-methyl, 4-chlorophenoxyacetic acid). This has been a very promising mixture to control not only chickweed but also other winter annual broadleaf weeds that are competitive to the establishment of alfalfa. Results of this combination have been somewhat erratic and point to further need for a study of time application of the spray and rates of the two materials, before it can be safely recommended for farm use. (Project B-58-c)

Classification on the basis of conformation is a necessary part of a sound breeding program.

Animal Husbandry

Research endeavor in animal husbandry is directed primarily toward the practical adaptation of Maryland's livestock production to the needs of the farmers and the preference of the consumers. To do this, the limitations as well as the advantages of the area are taken into consideration. For example, more meat is consumed in the Northeast than anywhere else in the United States, but the Northeast is a grain deficit area. It is important, therefore, to make the maximum use of pastures and roughages and yet produce a product that will meet consumer preference.

The development and improvement of technics for determining the more rapid gaining, and more efficient beef cattle have been emphasized because of their important bearing on the herds in the area, as well as on intensive prof duction methods. The development o the Maryland No. 1 meat type hog and the comparison of its productivity with the older established, standard breeds is timely for the producer and consumer. Pasture improvement has been accompanied by a somewhat parallel increase in bloat, so studies of its cause and prevention in cattle and sheep are receiving increased emphasis.

The conducting of the various research projects is in close cooperation with other University departments having a mutual interest, other State Experiment Stations, the U.S.D.A., and livestock farmers. Information resulting from this work is disseminated through publications and at field days, short courses, and other meetings.

BEEF CATTLE

Average Birth Weights May Help Farmers in Beef Performance Testing

It is desirable for many reasons to secure the actual birth weights of calves, but some beef cattle raisers consider that they do not have enough time to secure these weights. Studies have been completed which indicate

that approximately as reliable estimates of 180 day weights may be made by using average birth weights as by using actual birth weights when either of those weights is used along with a second weight taken near to the six months' age.

Estimated 180 day weights have been made by use of three different methods (I) actual birth weight and a 146 day weight, (II) actual birth weight and a 202 day weight, and (III) 146 and 202 day weights. These estimates were compared to actual 180 day weights. The average actual 180 day weight for the 79 calves used in the study was 341 pounds and the average estimated 180 day weight by each of the three methods was 338 pounds. The average differences between actual and estimated 180 day weights were 11.5, 10.4, and 8.3 pounds for methods (I), (II), and (III), respectively.

When average birth weights were substituted for actual weights, the average estimated 180 day weights were 338 pounds for method (I) and 339 pounds for (II). Average differences between actual and estimated 180 day weights were 11.7 and 10.6 pounds, respectively, for methods (I) and (II). As these latter average differences were so close to those when actual birth weights were used, it was concluded that the substitution of average for actual birth weights for estimating 180 day weights might be satisfactory for most practical purposes.

A second study was made wherein 180 day weights were estimated by means of using both actual and average birth weights and a second weight taken within the range of 150 to 210 days of age. The estimated 180 day weights, based on actual average birth weights, were practically identical in the study (85 calves used).

Weights of cattle taken regularly will provide records which can point the way to more net profit.

If further studies agree with the results secured to date, it may be that one obstacle which prevents some farmers from starting a weighing program for their calves—namely, taking birth weights—may be removed thereby allowing a more widespread application of performance testing. It should be added, however, that in the opinion of the research workers, the securing of actual birth weights is of sufficient importance for reasons other than estimating later weights that the actual weights should be secured if at all possible. (Project C-14)

Bloat Research Expanded

One of the results of the survey on the frequency and importance of bloat which was reported in the 1952 Annual Report has been an expansion of the scope of the research work. Further cooperation has been established with the University's Departments of Dairy Husbandry and Bacteriology and with the Animal and Poultry Husbandry Research Branch, Agricultural Research Service, U.S.D.A. In the initial work, emphasis has been given to the development of improved technics for the determination of the chemical reactions taking place as the result of bacterial activity in the rumen. This work is preparatory to making comparisons between animals with bloat and normal animals.

Contact has been made with cattlemen in order to locate bloated animals during the summer months.

(Project C-18)

Measurement Studies Continued and Enlarged

Further studies have indicated that the combined weight of three wholesale cuts (round, trimmed loin, and rib) of beef steers may be estimated with a rather high degree of accuracy by use of only two to four linear measurements taken on the live animals. When the mid-rump to rear flank, width of thighs, width of shoulders, and circumference of heart girth measurements were used, the multiple correlation coefficient (R) of the weight of the cuts and these measurements was 0.919. When the first measurement listed was eliminated, R equalled 0.915 and when only the latter two measurements were used R equalled 0.910. All correlations were statistically highly significant.

Forty different bodily measurements were correlated with the dressing percent in the same fifty steers reported previously. Width of shoulders was the only measurement which was found to be significantly correlated with dressing percent ($r = 0.3$) but even it was of low predictive value. It appears that some of the criteria used in judging practices need to be studied in more detail.

Forty-six different measurements are being taken on the calves which are being fed individually under project C-14-a in order to study bodily measurements and proportions as the calves grow and the relationships of the measurements to rate and economy of gain. So far, 3,800 individual measurements have been secured on the 31 calves fed during the past year. The data of this study will be analyzed in the future. (Project C-14-c)

Study Feed Requirements For Maintenance and Growth of Beef Calves

A study has just been completed wherein by use of statistical procedures, the feed consumed by calves on full feed was divided into that used for growth and that used for "maintenance" or non-growth uses. These latter uses include the feed needed to maintain the minimum essential life processes, to digest feed, for physical activity and other bodily functions. Data secured from 85 Aberdeen Angus and Hereford steer and heifer calves fed individually and *ad lib* from weaning (90 or 180 days of age) to 370 days of age were the basis for the study.

The data included average live weights during the feeding periods, daily rate of gain, and average daily feed consumption. The total feeding period was divided into sub-periods, the latter were from 90 to 202, 90 to 370, and 202 to 370 days of age. Energy content of the feed was calculated in terms of total digestible nutrients (TDN) and net energy (NE). The later is equal to the TDN minus the energy lost through bodily excretions and that used in digesting the food.

If was found that the energy used for maintenance was the lowest in the calves of the 90-202 day age group, next in the 90-370 day age period and highest during the ages of 202 to 370 days. About 53 percent of the TDN was used for maintenance by 90 to 202 day group, 67 percent in the 90 to 370 day age period, and 74 percent during the ages of 202 to 370 days. A statistically significant difference was found between sire progeny groups in the amount of TDN required for maintenance. The sire groups did not differ significantly in the amount of TDN necessary per pound of gain.

(Project C-14-a)

SHEEP

Study Effect of Sodium Propionate On Growth and Condition of Sheep

Studies have been made on the effect of sodium propionate on mature sheep and lambs. The rate of gain and observed health and condition of creep-fed lambs were not significantly affected by the feeding of sodium propionate. Hampshire lambs receiving propionate gained 0.58 pounds per head per day as compared to 0.51 pounds per day for lambs getting no propionate, while propionate fed Southdown lambs each gained 0.43 pounds and the control groups gained 0.44 pounds daily.

Blood glucose levels of group fed pregnant and lactating ewes were not changed by sodium propionate when it was fed at a rate of 0.1 pound per ewe per day and the total feed allowance was 100 percent of the Morrison Standards.

Two pregnant ewes fed at 37.5 percent of the Morrison Standards developed a marked hypoglycemia, and blood glucose was increased when the ewes were drenched with two to four ounces of sodium propionate per day. Blood glucose fell to an average of 24.5 milligrams per 100 milliliters of blood during fasting and increased to 55.4 milligrams per 100 milliliters within four days when the ewes were given propionate. Other ewes similarly fasted before lambing did not show such a hypoglycemia and sodium propionate drenching did not affect the blood glucose levels observed. Fasted ewes that developed low blood sugar levels maintained good appetites and lambed normally.

When ewes were fed at 62.5 and 75 percent of the Morrison Standards their blood glucose values remained in the normal range (40 to 60 milligrams per 100 milliliters of blood) and no consistent differences were observed when such ewes were drenched with from two to four ounces of sodium propionate per day.

(Project C-21)

SWINE

Summarize Data on First 10 Years of Development of Maryland No. 1 Breed

A review of the development of a new breed of animals is usually of interest in order to see just what changes took place and what results were secured. The first years' work of the formation of the breed included a series of crosses and backcrosses of the Danish Landrace and Berkshire breeds. First, crossbreds were produced. These were mated to the Berkshire breed and resulted in pigs of the ratio of ¾ B., ¼ D.L. Later these were crossed to Danish Landrace boars to give the 5/8 D.L., 3/8 B. ratio. After 1943 no

The large proportion of lean to fat as shown by these cuts (loin, bacon and ham) is one reason why Maryland No. 1 carcasses are rated "highly desirable."

new animals were introduced into the herd. The coefficients of inbreeding of the litters rose from a little over 6.0 in 1943 to 29.6 in 1950. The average number of pigs born alive per litter in any one season varied from 5.9 to 8.9: the ten year average, as well as that for the last two years, was 7.3. The average number of pigs weaned per litter per season ranged from 0.8 to 7.3, an average of 6.2 found for the last four seasons (spring and fall of 1949 and 1950). Average weaning weight per pig per season was found to be from 24.8 pounds to 37.8 pounds (average 32.3 during the last two years). Birth weights ranged in average from 2.6 to 3.5 pounds, a 3.0 pound average being secured during the last two years.

A total of 36 boars was used, 17 were used for only one season, 15 for two seasons, two for three seasons, and two for four seasons. From 1944 through 1950, 4.1 percent of the males weaned were used for breeding purposes.

One-hundred-seventy-six different females had a total of 346 litters. Eighty-one females had one litter, 61 had two litters, and the numbers having 3, 4, 5, 6, and 7 litters were 13, 8, 8, 3, and 2, respectively. An average of 18.5 percent of the sow pigs weaned were used for breeding purposes. The boars averaged 15.7 months of age when their litters were born and the females averaged 18.6 (average generation interval was 17.2 months). Fifty-four percent of the litters were sired by yearling boars and 47.0 percent of the litters were from gilts. A bulletin is being prepared describing in more detail the development of the line.

During the past year, 18 litters of Maryland No. 1 pigs have been farrowed. Litter-lot feeding is being continued in order to test the productivity of the line. Breeding stock has been sold to breeders in six states, Iowa, Illinois, Indiana, Maryland, Virginia, and North Carolina. (Project C-20)

Develop Method of Producing Test Antigens for Anaplasmosis

Anaplasmosis is still a factor in cattle health in some sections of Maryland. In some western states it is a very serious threat to cattle production. Studies have been continued, looking toward the perfection of a testing antigen for the complement fixation test. The antigens produced by methods worked out in this laboratory have proven satisfactory in comparative tests conducted with workers in Louisiana and Oklahoma. Laboratory workers in these and other states have been able to produce satisfactory antigens by following procedures worked out in Maryland. Herd tests have been made to determine the extent of infection, so that diseased animals may be removed to isolation or to slaughter. When the testing procedure becomes established throughout other states, it will be possible to promulgate regulations to prevent the introduction of infected animals into Maryland.

(Project D-50)

Study Modifications of Newcastle Disease Virus

Newcastle disease can be produced in hamsters after 330 passages in the brain of that animal. The virus has been changed in this process so that it will not produce disease in six-week-old chickens when injected under the skin. However, it will still produce disease in one-day-old chicks by several other routes of injection.

The virus was shown to be present in or on red blood cells of mature chickens examined under the electron microscope 48 to 96 hours after the birds were injected into the muscle.

Young rabbits were shown to be susceptible to several strains of Newcastle disease virus by brain injection. One of these strains of virus produced disease in one of two rabbits when the animals were exposed by the instillation of material into the nostrils.

Newcastle disease virus has been purified and concentrated by centrifugation, by chemical procedures, and by electrophoresis. These purified and concentrated suspensions are valuable for studies of testing processes.

(Project D-52—N. E. 5))

Find New Approach to Ketosis In Ruminant Metabolism Study

Basic research on ruminant metabolism has led to the development of a new approach to the problem of ketosis. It now seems probable that further investigation may yield information which will make possible the elimination of this disorder.

Veterinarians in England, The Netherlands, and New Zealand, confirming work originally done at the Live Stock Sanitary Service Laboratory, have reported success in the treatment of pregnancy disease of sheep with glycerol. If treated early enough, many sheep developing pregnancy disease may now be saved. Investigation of the use of propylene glycol for the treatment of ketosis is continuing, but it cannot yet be recommended for general use.

(Project D-53)

Small-Dose Vaccination Halts Brucellosis in Newly Infected Herds

The work reported in 1952 and 1953 on small-dose vaccination, designed to prevent the spread of brucellosis in newly infected herds, has been continued. The results have continued to show that the spread of infection ceases almost at once after such vaccination, and the blood titers so produced are usually quite transient. The study of "booster" shots in previously vaccinated calves and adults has also been continued, as reported the last two years. This type of vaccination has proved particularly effective in infected herds where new animals are frequently being added.

In an effort to find some method of measuring the resistance of an animal to brucellosis, experiments with embryonating eggs were begun during the past year. It was found that seven-day embryonating eggs, inoculated with 75 organisms of one strain of *Brucella abortus* will die within three days. This information has been used as a basis for the study of various blood sera. Any prolongation of life over the three-day "life span" of the infected control eggs indicates that the blood serum has some protective quality. Some of the sera may increase the life of the embryo only a day or so over that of the control eggs, while other sera may protect the developing embryo during the entire embryonic period and the chick may hatch. This work has not progressed sufficiently far to draw any conclusions, but the indications are encouraging and the study will be continued. (Project D-46)

Substantial Milk Gains Result of Rounded Mastitis Control Program

The various types of mastitis infection in Maryland and the present facilities for an effective plan of control are being investigated. This is being done by bacteriological examination of the milk of each cow in an ever increasing number of herds. Results of these examinations are compared with milking procedures and the degree of sanitation in the herds on test.

Spot treatment of cows showing flaky milk, without testing the remainder of the herd, never seems to bring any lasting benefit.

The more progressive owners, who follow procedures recommended by their veterinarian and the University, benefit in every respect. Substantial milk gains, exclusively due to healthier udder conditions, can be shown in a large number of cases. (Project D-54)

The protective quality of various blood sera is measured by inoculating embryonating eggs with brucellosis organisms.

Botany

Research in the Department of Botany consists of studies which have immediate application to farming operations in Maryland and of studies of a more basic nature which will serve as the foundation for future practical developments. It includes work in the fields of plant breeding and cytogenetics, plant physiology, and plant pathology.

Some of the current work is pointed toward development of improved varieties of crop plants and of varieties possessing resistance to disease; toward a better understanding of the role of trace elements such as boron in plant nutrition and the nature of the effect of fungicides on fungi; and toward development of improved methods of controlling destructive plant diseases in Maryland through the use of spray programs and chemical treatment of seed and soils.

Members of the research staff in Botany work closely with their colleagues in the various other departments in carrying out the Experiment Station's broad program of improving agriculture in Maryland.

Comparison of effect of black rot fungus on Maryland Golden and Sunnyside varieties of sweetpotato. La. indicates Louisiana isolate of *Ceratostomella fimbriata* and Md. indicates Maryland isolate.

PLANT PATHOLOGY

Sunnyside Variety of Sweet Potato Black Rot-Resistant

Resistance of the sweetpotato variety Sunnyside to the black rot disease was shown by several laboratory tests. Using two isolates of the black rot fungus, it was shown that Maryland Golden was extremely susceptible; Oklahoma 46 was very susceptible; Shoreland showed some resistance; and Sunnyside was highly resistant. Differences in pathogenicity of the two isolates tested indicate that breeding for resistance to black rot will probably be greatly complicated by occurrence of pathogenic races of the casual organism. (Project J-86-a)

Disease-Resistant Potato Varieties Tested for Maryland Adaptability

Early blight attacks potatoes in Maryland almost every year. Several virus diseases are also often present and late blight causes serious losses in some seasons. Varieties with resistance to these and other diseases which will produce good yields of high quality potatoes without the expense of an extensive spray program are needed.

In 1953 test plots on the Eastern Shore of Maryland, no late blight occurred, but early blight was present and caused heavy defoliation in late plots planted on July 11.

In early season plots the varieties Pungo, LaSota, and Marygold produced significantly more No. 1 potatoes than Irish Cobbler in plots sprayed

Differences in defoliation of potato seedlings and varieties by the early blight disease show up in experimental plots on the Salisbury Vegetable Research Farm.

with a fungicide. In plots receiving no fungicide LaSota outyielded Irish Cobbler.

In late season plots Kennebec yielded significantly more No. 1 potatoes than Irish Cobbler in plots receiving fungicidal sprays while in plots receiving insecticide only Kennebec, Marygold, Sebago, Katahdin, Pontiac, and Pungo were all superior to Irish Cobbler. Certain seedlings notably B606-67 and B355-44 also performed well. The latter was less affected by early blight than any other varieties or seedlings in the test. (Project J-90)

Progress Made on Identification & Control Of Plant Virus Diseases

Economic losses due to virus disease are considerable each year in Maryland crops. Estimates on losses are difficult to make, partly because of a lack of satisfactory standards of measurement and partly because virus diseases may cause lower yields and quality in crop plants, without killing them.

There is constant need for identification of new viruses and their hosts. Control measures are varied for different crops. Roguing diseased plants, production of disease-free stock as with peach and strawberries, development of disease resistance as in tobacco and control of insect vectors are a few of the control procedures.

Continued progress is reported on a spray program for controlling insect vectors of strawberry virnses. New varieties tolerant to the virus complex have been issued to nurserymen. A method has been found for indexing strawberry plants for virus diseases.

Surveys have continued on the extent of peach yellows (and cherry yellows) in Maryland. Eradication of diseased plants and control of insects help cut down the incidence of peach yellows. Many growers are now obtaining disease-free stock.

Indexing of young chrysanthemum propagations in Maryland has brought to light the virus Q and one undetermined virus. Results of tests indicate that several Winkler's varieties were infected. As Winkler's varieties are used for breeding stock in U. S., indexing should be instituted to obtain virus-free stock. (Project J-88)

Growers Evaluating Red Stele Resistant Strawberry Selections

The feasibility of obtaining multiple resistance to the red stele disease in combination with resistance to foliage diseases and desirable fruit characteristics has been demonstrated by past work on this project. A number of strawberry selections have been developed that have high disease resistance and the many other features necessary in a commercial strawberry. Two of these selections were planted by strawberry growers under their own conditions and have made excellent vine growth. Evaluation by growers will be an important consideration in determining which selections should be introduced.

A new planting of about 5,000 seedlings was made and about 100 new selections were propagated for future testing.

It was found that methyl bromide and chloropicrin can be used to eradicate the red stele fungus from naturally

infested soil. They may be of some value to nurserymen or in other situations where elimination of red stele in a small area is of importance.

(Project 78-a)

Disease Resistance Bred Into Improved Strains Of Maryland Tobacco

Probably the most practical and effective method available for disease control is to develop resistant or immune varieties to diseases. Tobacco lends itself very well to a program for developing resistance to diseases. There apparently are a number of genes or carriers of heredity for disease resistance in commercial tobaccos and related species. These factors for resistance have been utilized in developing new varieties of tobacco resistant to some of the major diseases of tobacco; namely, mosaic, black root rot, wildfire, black shank, Granville wilt, and fusarium wilt

Stelemaster, a joint introduction of the University of Maryland Agricultural Experiment Station and the U. S. Department of Agriculture, is a product of breeding and selection for red stele resistance. Stelemaster possesses resistance to other diseases, as well as excellent market qualities.

Although development of resistance is an effective method for disease

Black shank resistant selections growing on naturally infested soil in St. Mary's county. Selections are the F_5 of a cross between Florida 301 X Maryland Robinson. All susceptible plants shown are grower's strain.

control, it requires a number of years. The time may vary from six to ten years from the time the first cross is made until a plant is produced suitable for the industry.

At present resistance to fusarium wilt and black root rot is present in certain Maryland varieties. In 1954 seed of the best selections resistant to mosaic, black root rot, and wildfire (black fire) will be increased for farmer trial in 1955. Resistance to the three diseases has been combined in a single variety. Some of the selections outyield and have as good quality as some of the best existing Maryland tobacco varieties.

Because of the urgency of obtaining a variety resistant to black shank, an increase in seed supply will be made this year to give to growers who have black shank infested land. Black shank has spread to widely scattered areas in the five major tobacco growing counties. At present 48 farms have the disease. Two farms had the disease in plant beds in 1953. From these two beds eight farms became infected with the disease. Another serious soilborne disease is Granville wilt which has been found in five tobacco growing counties on 15 farms. Crosses have been made between the dual resistant Florida Kincaid and three Maryland varieties. Kincaid is resistant to black shank and Granville wilt. Crosses have also been made between the flue-cured dual resistant Dixie Bright 102 and Maryland Robinson which is resistant to fusarium wilt; also between Dixie Bright 102 and Maryland Catterton, resistant to black root rot.

Anthracnose, a fungus disease of tobacco which causes considerable damage to tobacco beds in certain years, has been inoculated on 42 species of *Nicotiana* and several tobacco varieties. All plants inoculated were susceptible. Some species, however, show a high level resistance to the disease. Work will be started on crossing resistant species with Maryland tobacco to introduce resistance to Anthracnose.

(Project J-89)

Field Tests Evaluate Sprays for Control Of Vegetable Diseases

Early blight and gray leaf spot are among the diseases which generally cause defoliation of tomatoes in Maryland. These two diseases were present in experimental plots in which eight fungicides and combinations of fungicidal materials were tested in 1953. Several of the materials resulted in good control of diseases. This was reflected in increased yields. The organic fungicides, zineb and maneb, were quite effective in controlling gray leaf spot and early blight.

In the laboratory it has been shown that some of the fungitoxic compounds affect enzymatic processes in fungi. Some of these materials affect processes which release energy for use by the fungi; some of them affect formation of new cell substance and others affect transfer of energy to synthetic processes. The organic fungicide, captan, appears to affect growth of fungi by interference with decarboxylation reactions requiring thiamine pyrophosphate.

(Project J-91)

PLANT BREEDING

Sorghum Species Studied To Find Possibility Of Developing Hybrids

Many of the species of *Sorghum* are strikingly different in appearance. Some species are characterized by tall, profusely branching plants with long narrow leaves while other species have short, non-branching plants with wide leaves. Many less obvious differences among the different species may also be detected by careful observation. The relationships among the various species of *Sorghum* are being studied by analyzing interspecific hybrids.

Microscopical studies of the structures carrying the hereditary units have shown that some *Sorghum* species

Extreme left—inflorescence of the Black Hull Kafir variety of *Sorghum vulgare*. Right: inflorence of *S. Almum*. The other inflorescences are those of different hybrids between *S. vulgare* and *S. almum*.

have ten chromosomes while others have twenty or forty. Despite differences in chromosome number of the species, studies during 1953 disclosed that pairing between the chromosomes of the two parental species occurred during the formation of the pollen in the hybrid. The pairing of the chromosomes in the *Sorghum* hybrids together with the absence of detectable changes in chromosome structure show that the species of *Sorghum* are closely related. (Project F-16)

X-Ray Treatment Increases Number of Multiple Corn and Lily Seedlings

Although the effects of X-rays on the hereditary material of plants have been investigated intensively for many years, the effect of X-irradiation upon embryological development has received little attention. Recently the plant breeders of the Botany Department observed that numerous multiple seedlings of corn and regal lily developed from seed formed after X-ray treatment of the pollen. Since the members of twin and triplet seedlings are useful in plant breeding, a program was initiated to determine the most efficient X-ray treatment for the production of multiple seedlings.

During the past year approximately 1,500 crosses utilizing X-rayed pollen were made in corn. More than 30,000 seeds have been germinated in a search for multiple seedlings. The results show that the development of multiple seedlings is dependent upon the magnitude of X-ray treatment. Twin and triplet seedlings were a hundred times more frequent following the most efficient treatment (5,000 r units) than in the normal seeds. A similar experiment has been initiated to induce formation of twins in species of lilies by treating pollen with X-rays.

Twenty-eight experimental lines of peppers developed from twin seedlings are being tested during 1954. The lines having improved fruit quality will be maintained and increased for further observation. (Project F-15-b)

Boron Improves Action Of Plant Growth Regulators

The boron-hormone-sugar interrelationship was demonstrated not only for sucrose, but also for frutose and glucose; similarly, boron accelerated not only the action of 2, 4-dichlorophenoxyacetic acid, but also 2,4.5-trichlorophenoxyacetic. naphthalene acetic, and indolesacetic acids. One current line of research is directed toward finding the precise manner by which boron enhances the movement of sugar in plants. In addition, workers at this Station, in cooperation with the U. S. Department of Agriculture, are exploring the possibility that other essential elements may also affect sugar movement and, hence, hormone movement in plants.

Pronounced differences have been observed between the water relations of leaves of boron-deficient and boron-sufficient snap bean and tomato plants. An hypothesis is being tested in an attempt to explain these differences.

A deficiency symptom that frequently occurs on snap beans under field conditions has been shown to be reproducible by the omission of boron from a nutrient solution. (Project K-8-c)

Leaf Analysis Points Way To Efficient Fertilization

In order that the mineral requirements of plants may be evaluated, the relationship between the chemical composition of plants and yield must obviously first be determined. At present there is very little information on which to evaluate a chemical analysis of plant material once it is made. As a result of this study, at least tentative "sufficiency values" for calcium, potassium, and phosphorus in alfalfa are available, and some data are available for certain other crops. It is believed that knowledge of this type will help to determine whether an element or elements are needed by plants, and how far the internal concentration of the element is below the optimal level.

The phenomenon of "internal balance," among elements, is not regarded as a deterrent in the ascertainment of "sufficiency values." The fractions of calcium, potassium, and phosphate which are extractable from dried, ground plant material appear to correlate as closely with ultimate yields as does an anlaysis for total amounts of these elements. (Project K-8-b)

Dairy

Dairy research at the Maryland Agricultural Experiment Station has been divided into the two major phases of dairy production and dairy technology. In dairy production, the problems receiving attention during the past year have dealt with dairy cattle health, evaluation of feeds for milk cows, physiology of milk secretion, and factors affecting digestive action in the rumen. In dairy technology the major emphasis has been on various problems dealing with fats in dairy products, including the relationship of milk fat to flavor in both ice cream and milk and tests for detection of foreign fats in dairy products. Other studies have included tests for total solids in milk and the use of farm holding tanks in storing milk.

PRODUCTION

Develop Method to Use Radioactive Tracers in Milk Secretion Studies

The results of experiments in which cows and goats were milked at short intervals with the aid of oxytocin, the milk letdown hormone, have been statistically analyzed and form the basis of a new concept in radio-active isotope studies of milk secretion. Based on this work, methods have been developed and tested for increasing the specific activities of milk components in tracer experiments with living animals. It has been shown that there is a pooling of milk in the mammary gland. Equations have been de-

Using a Geiger counter to trace the metabolic pathways of radio isotopes injected to study the formation of milk.

veloped for understanding precursor-product relationships involved in milk secretion. These equations explain the anomalous results obtained by other workers in tracer studies of milk secretion using radio-calcium. These equations can also be applied to better understand the mode of action of hormones in altering milk secretion.

A tracer study using the perfusion technique has definitely established that beta-hydroxybutyric acid is of major importance as a precursor of the volatile fatty acids in butterfat.

(Project G-43)

Cortisone-Related Compounds Effective In Ketosis Treatment

Several years ago research workers at the Maryland Station demonstrated that ketosis, or acetonemia, in dairy cows is associated with improper functioning of the adrenal and pituitary glands at the time of calving and during the period immediately following calving. It was shown that the injection of cortisone, or ACTH, into cows with ketosis resulted in a rapid recovery. Several compounds, closely related to cortisone, were also found to be effective.

During the past year 75 cases of ketosis have been treated with various new cortisone-like substances. Hydrocortisone alcohol was found to be more potent for the treatment of ketosis than cortisone acetate or hydrocortisone acetate. 11-ketoprogesterone was also effective in the treatment of ketosis, but was slow in action and larger amounts were required. Combinations of hydrocortisone alcohol and hydrocortisone acetate were more effective than hydrocortisone alcohol alone.

In previous studies the injection of ACTH into normal cows resulted in a marked increase in blood sugar and a decrease in milk production. Studies during the past year showed that a similar effect was obtained when as much as 5 grams of hydrocortisone alcohol, cortisone acetate or hydrocortisone acetate were used, hydrocortisone alcohol having the most marked effect. Thus, it appears that the effects of ACTH are due to the secretion of highly active glucocorticoids by the adrenals of cows following the injection of ACTH. This provides additional information on the mode of action of ACTH in bringing about the recovery of cows with ketosis. The decrease in milk production following the injection of ACTH and the glucocorticoids lasts but a few days when the amounts administered are not in excess of recommended doses.

Further studies on the levels of acetic, propionic, and butyric acids in the rumen of ketotic cows have failed to reveal any differences that cannot be attributed to the cows going off feed. (Project G-37)

Extra Fat in Dairy Ration Doesn't Justify Added Cost

The results of a feeding experiment with 18 cows over an entire lactation showed that cows fed .120 pounds of fat per hundred pounds of body weight per day were slightly more persistent in milk production than cows fed .082 or .060 pounds of fat per hundred pounds of body weight. It is concluded that while some increase in milk production may result from feeding extra fat, there is insufficient evidence to warrant extra expenditures for fat over and above its energy value.

Preliminary studies showed that acetic acid and beta-hydroxybutyric acid, two substances produced in the rumen of cows, have an important effect on the amount of milk fat secreted. Feeding trials will be undertaken in an attempt to control the production of these two substances in the rumen of cows. In this way, it may be possible to control the amount of milk fat secreted (Project G-38)

Hormone Increases Milk Production of Heifers

Previous studies showed that a highly purified preparation of growth hormone (Armour) increased the milk

production of cows by as much as 100 percent for short periods of time. During the past year 100 mgs. of growth hormone were administered daily to two pairs of identical twin heifers, starting nine days before calving and continuing for sixteen days after calving in one case, and being administered for 23 days prior to calving in the second case. The milk production of one of the heifers receiving growth hormone was 30 percent higher than that of her twin during a 280-day lactation period, although they were fed identical rations. The 30 percent spread was maintained during the entire lactation period. The same relationship was observed in the second set of identical twins. It appears that when growth hormone is administered just prior to parturition, milk production of first-calf heifers is increased markedly and the lactation curve continues at a higher than normal level. (Project G-38)

Study Rumen Function

Acetic, propionic and butyric acids are important products of bacterial fermentation within the rumen, or paunch, of cows. They furnish a large portion of the energy required by ruminants and participate in a number of metabolic reactions within the animal body. Investigations have been made to determine from what substances in feeds these acids are formed, and to learn what other factors may affect their production within the rumen.

Studies on bacteria taken from the rumen demonstrated that various carbohydrates and amino acids are broken down by mixed suspensions of rumen bacteria (artificial rumen) with the production of volatile fatty acids (acetic, propionic and butyric). In addition, a starch-like polysacchraide is formed when carbohydrate is added to

Syphoning a sample of half-digested feed from the rumen for the study of chemical and bacterial processes of digestion.

the rumen bacteria. It was found that both the amount and the relative proportions of the volatile fatty acids produced are affected by the gaseous atmosphere of the fermentation flasks, the amount of bacteria present, and the time after feeding that the bacteria were obtained from the rumen. The bacterial suspensions were not able to break down carbohydrates as readily in the presence of aureomycin or terramycin.

The amounts of the volatile fatty acids have been determined in rumen fluid from cows under various conditions. Acetic acid usually accounts for 55 to 70 per cent of the total acids. Slight changes occur in the relative amounts of the volatile acids as time passes after feeding. No appreciable differences were found in the relative amounts of these acids in the rumen of cows fed hay alone, plus starch, or hay plus a dairy concentrate mix.

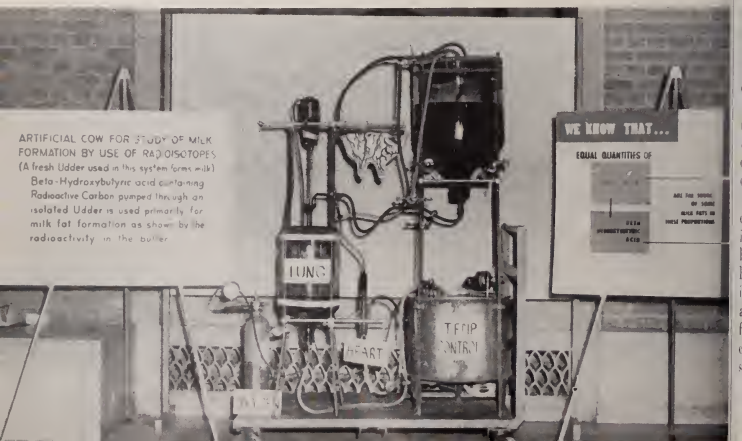
When succinate was placed in the rumen of a cow the amount of propionate in the rumen fluid increased. This confirms the observation from *in vitro* studies, using mixed suspensions of rumen bacteria, that succinate is converted to propionate by rumen bacteria. (Project G-39)

TECHNOLOGY

Chemical Test Useful in Predicting and Confirming Stale Flavor in Milk

The development of stale flavor in milk and dairy products, due to the oxidation of milk fat, is a troublesome problem for the dairy industry. Work is being done on the development of objective chemical tests for detecting milk fat oxidation in dairy products. A simplification of the thiobarbituric acid test for oxidized milk has been developed. The application of phenylenediamine as a reagent for measuring carbonyl compounds in oxidized milk is being investigated. The results indicate that these chemical tests are useful in predicting and confirming the development of oxidized or stale flavor in dairy products. (Project G-34)

The artificial cow developed at the University of Maryland attracted considerable interest at hearings before the subcommittee on Research and Development of the Joint Committee on Atomic Energy.



Develop Standards for Detecting Substitute for Milk Fat in Dairy Products

The illegal substitution of vegetable fats and animal body fats for all or part of the milk fat in dairy products is a matter of concern to the dairy industry and regulatory agencies. Dairy Department workers have proposed a chromatographic test for butyric acid as a method of detecting substitute fats in dairy products. A year's survey of milk fat samples from various parts of the United States is now being conducted in order to establish the normal values for the butyric acid content of milk fat. (Project G-35)

Test Synthetic Vanilla-Like Flavoring for Ice Cream

Propenyl guaethol is a recently perfected vanilla type flavoring material. It is a pure chemical which is a fine, free flowing, white powder. This product has a rich, sweet, delicate aroma and a pleasant vanilla-like taste. It appears to stimulate the sense of taste as well as contribute to the flavor effect. This product was tested to determine its value as a flavoring material for ice cream.

Observations indicated that the use of propenyl guaethol enhanced the flavor imparted to vanilla ice cream by vanillin or natural vanilla extract. Desirable flavor characteristics were obtained when ten percent of the natural vanilla requirements were used in combination with propenyl guaethol. Propenyl guaethol used in excessive amounts produced pronounced off-flavors.

When propenyl guaethol was used in chocolate and different fruit and nut ice cream, including strawberry, raspberry, pineapple, butter pecan, butter brickle and butterscotch, the results indicated that propenyl guaethol had a greater influence in enhancing the flavor of the nut and butter-type ice cream than that of the fruit flavors studied.

The most successful application of propenyl guaethol appears to be as a supplementing flavor to vanilla, chocolate, fruit and nut ice creams. In general, this study indicated that propenyl guaethol produced desirable results as a synthetic vanilla-like flavoring material for ice cream.

(Project G-42)

Check Accuracy of Test For Non-Fat-Solids in Milk

Increased emphasis is now being placed on the utilization of milk solids, as there is a growing market for the non-fat-solids in milk. Under these conditions, many dairymen question the practice of pricing milk on butterfat alone. Including the solids-not-fat content in the pricing of milk has been difficult because there has been no simple test for milk solids available. The dairy industry needs a quick, accurate test to determine the total solids in milk. The only sure way of determining total solids in milk has been the slow gravimetric oven drying method. Some new methods have recently been proposed, and they include a rapid drying method, chemical methods and the new lactometer approach developed by the U. S. Department of Agriculture.

Findings from experiments on the practical application of the new lactometer test indicate that the results for total solids of mixed herd milk checked within approximately 0.1 percent of the results obtained by the slower gravimetric method. Wider variations were encountered on milk samples from individual cows. The total solids content of milk, ranging in fat from 2.8 to 7.8 percent, from a number of individual cows of the Holstein, Jersey, Ayrshire and Guernsey breeds, has been determined by the new lactometer method and the gravimetric method.

The extreme variation of individual cow samples of milk ranged from minus 0.36 to plus 0.35 percent total solids, when compared with results ob-

tained by the gravimetric method, with a mean deviation for all individual cow samples of 0.17 percent total solids. This is slightly larger than the mean deviation of the mixed herd milk samples which was 0.10 or less.

The total solids determination has been made by the new lactometer method on the same samples of milk by two different research laboratories, completely independent of each other, and results show maximum differences in results less than 0.05 percent. There is need for more extensive data on this matter where conditions are more variable.

Factors possibly affecting the accuracy or the reliability of the new lactometer method include: milk from individual cows, effect of season, breed, stage of lactation, results of different laboratories and accuracy of the lactometer instrument.

In the practical adaptation of the lactometer test for determining the total solids content of milk, caution should be used in expecting extreme accuracy because of the constant variation in the specific gravity of the solids-not-fat content in milk, as well as the inaccuracies encountered in the calibration of the lactometer instrument.

(Project G-35)

Butterfat Important in Producing Smooth, Palatable Ice Cream

A microscopic technique, using an immersion method for texture studies, has been used to determine the role of butterfat in producing smooth, palatable ice cream.

Fat globules in the internal structure of ice cream were identified by optical method in this investigation. Thin sections of ice cream were observed by the use of the microscope. The immersion method was applied, which consisted of selecting two different immersion liquids. The refractive index, 1.447, of the first immersion liquid was very close to the refractive index of fat, 1.453. This immersion liquid blanked out the fat globules while it showed air cells, ice crystals and unfrozen material. The second immersion liquid used was acetone or ethyl acetate, refractive indices, 1.357 and 1.378, respectively, which enabled the identification of the fat globules. Fat globules appeared to be located partly in chain-like arrangements around the air cells, and many fat globules were individually dispersed throughout the unfrozen material.

Organoleptic and microscopic examinations indicated that there was a fat-air orientation in the internal structure of ice cream which presumably influenced the smoothness and mellowness of ice cream.

These findings have practical application in the production of ice cream and also supply valuable technical information.

Attempt to Find Cause of Browning in Heated Milk

Work has continued on attempts to isolate and characterize the brown pigments found in highly heated milk. The brown material obtained by water extraction of heated milk has been concentrated and further purified by dialysis and crystallization procedures. The brown concentrate contains carbonyl groups and methods for obtaining crystalline derivatives of the carbonyl compounds are being studied.

(Project G-40)

Begin Study of Farm Milk Holding Tank Systems

The new farm holding tank milk procurement system used for cooling, storing and transporting milk from the farm to the processing plant has been used in Maryland for over two years. This system replaces the conventional ten-gallon milk can with a stainless steel bulk cooling tank equipped with an automatic refrigerating system and mechanical agitation. Milk is strained directly into the tank, cooled

and held until received by the farm tank pick-up truck.

There is need for knowledge regarding the effect of this newer system upon the keeping qualities of milk in both the raw and pasteurized state. Rapid cooling and low temperature storage for varying periods of time may possibly lead to the development of bacteriological and enzymatic changes which would directly affect the keeping quality and which have not been, heretofore, encountered by milk procurement methods commonly used. A 300-gallon farm milk tank has been installed at the University dairy farm and an investigation is being initiated. Early results indicate that rapid cooling and low temperature storage for varying periods of time may possibly lead to development of bacteriological or enzimatic changes affecting keeping quality of milk which have not been heretofore encountered. (Project G-44)

Exterior view of the farm bulk milk tank showing agitator motor, measuring rod and thermostatic control for refrigeration system. This farm bulk milk tank is installed at the University dairy farm for investigational purposes.

Entomology

New Insecticides and New Type of Sprayer Increase Snap Bean Yields

The average snap bean yields in Maryland have not reached two tons per acre since the Mexican bean beetle became established in the State in 1928. Before this time average yields of two tons per acre or more were often obtained. With the new insecticides, malathion and dilan, applied with equipment developed at this Station, yields of three to five tons are being obtained from experimental plantings. These insecticides and the equipment are being thoroughly tested on commercial acreages this year.

The objective of this work is to increase Maryland snap bean yields by three-fourths ton per acre within the next three years, through correct and timely sprays. (Project H-29-g)

Sprays Help Canners Control Vinegar Gnats

First eggs of *Drosophila* on tomato fruit were found in the field and at canning plants during the last week of July. The field populations increased until August the 15, then several weeks of dry, hot weather reduced the number of adults to a negligible level until after the middle of September. Addi-

This adaptation of a Slosser-type boom for application of concentrated sprays for insect control on snap beans has proved highly efficient in commercial operations.

Experimental spraying of tomatoes for pest control with a broadcast-type boom is particularly effective after plants have become matted between the rows.

tional data obtained shows that even when few adult gnats are present about plants, eggs may be abundant on raw stock. The number of eggs present on tomatoes awaiting processing reflect conditions in the field and not necessarily conditions at the canning plant.

Skin piles do not appear to be an important source of *Drosophila* but they should be sprayed with malathion at the residual dilution twice a week to prevent breeding of houseflies.

Electric atomizing sprayers were used in applying pyrethrum aerosols and mists. These machines appear to be of value in keeping down in the plant gnat populations when used frequently.

Malathion residual sprays, 1 quart of 50 percent emulsifiable concentrate in 12 gallon of water, used on walls and ceilings of unloading platforms will kill many gnats. The treatment of empty baskets with such a solution of malathion is helpful in preventing oviposition at crucial times after tomatoes are picked.

Previous recommendations in regard to sanitation should be followed and pyrethrum sprays of some kind used. Some of the commercially available pyrethrum insecticides should be used at a slightly stronger dilution than usually recommended.

(Project H-29-k)

Lindane and Dieldrin Control Insects of Cucumbers for Pickles

The control of both the spotted and striped cucumber beetle on young cucumber plants is necessary in order to secure a standard in experimental plots. Control of these insects reduces the occurrence of bacterial wilt. In three years work at the Experiment Station, the highest yields of pickles have been obtained where young plants were sprayed with an insecticide followed by later sprays of fungicide and foliage nutrient.

Lindane and dieldrin have given best results for spraying cucumbers for pickles, though lindane should not be used after blossoms appear on the plant. Extensive tests indicate that lindane does not cause off flavor in brine of pickles but when sprays were applied during the picking season, pasturized pickles from lindane sprayed plots were unfit for consumption.

(Project H-29-l)

Concentrate Sprays Better Than High Volume Sprays On Many Vegetable Crops

Old fashioned high volume sprays are expensive to apply, require high cost equipment and are wasteful of insecticide. Concentrated sprays are less wasteful of insecticide as there is no run off. They can be more rapidly and cheaply applied with light weight, low cost equipment.

Experimental results on tomatoes, potatoes, cucumbers, cantelopes, beans, alfalfa, broccoli, and cabbage show that the amount of spray may be reduced from 150 to 25 gallons per acre without any reduction in the effectiveness of the application. In fact, in many instances, the concentrated sprays are considerably more effective than high volume sprays.

Results indicate that boom design and nozzle placement are important for securing the desired coverage of the crop. For example, aphids usually feed near the tops of plants and hollow cone nozzles on a broadcast boom will give maximum coverage of this region of the plant. Spittlebug on the other hand feed on the stem of plants near the ground and a penetrating spray is needed. Flat nozzles on a broadcast boom should be best to give the type of coverage required. Preliminary results indicate this is true.

Because of the tremendous increase in the use of insecticides on the farm, this is considered one of the most important entomological projects. The Agricultural Engineering, Botany (Plant Pathology), and Horticulture Departments are assisting in this work.

(Project H-46-d)

Spray, Aerosol and Dust Compared For Garden Insecticide Application

Three years work has been done on the testing of various insecticides in liqnified gas aerosol formulations for the home garden. During the 1953 season the acrosol method of application was compared with the same insecticide (malathion) applied in water sprays and as dusts. The insecticide was used at the strengths commonly recommended for the different methods of applications.

On gardens of the same size and with the same number of treatments a total of 39.5 pounds of aerosol was applied, 119.2 gallons of spray and 156.5 pounds of dust. The total amount of actual insecticide applied was 382.9 grams in spray 716.8 grams in aerosol and 2840.8 grams by dusting. The results of the three methods on kill of insects and yield of crops was best where the most actual insecticide was applied.

Manufacturers recommendations for dilution of small volumes of sprays are based on the amount per acre recommended for commercial treatments in 100 gallons of water. For example, a pint of malathion is recommended per acre in power sprayers, 1 tablespoon per gallon of water would be recommended for the home gardener. From the results secured in this work, this would certainly not be sufficient. This problem needs more study.

(Project H-46-c)

Taxonomic Study Completed

With the publication of the classification of the Coccid family *Acleridae* as Bulletin A-75, in February 1954, the project was completed and a new project on the Coccid group *Toumeyella* started. (Project H-54)

Investigate Greenhouse And Nursery Crop Pests

Large scale tests of the control of the boxwood psyllid that curls the terminal leaves of box plants showed malathion very effective when applications are made early in March.

Applications of systemic phosphatic insecticides to the foliage and to the soil for the control of the box leafminer and the holly leafminer appear to be quite effective in both cases.

During the year the control of the Florida red scale on orchids (*Coelogyne cristata*) and the long tailed mealy bug on *Phaius grandiflora* was affected by the use of the DDT emulsion developed at the Experiment Station. A mite *Brevipalpus australis* Tucker that attacks Dendrobiums and other genera of orchids was controlled by the use of Kilmite, Dimite, and Red Arrow garden spray. The eriophyid mite *Aceria* was controlled on seedling cattleya by the use of the emulsifier Triton X-100.

(Projects A-35 and H-50)

Number and Timing of Sprays Important in Corn Earworm Control

The use of power spray equipment and insecticide formulations that are effective in the control of sweet corn pests is being found by farmers and canners to be practical. The acreage of corn being commercially treated has increased for the past several years. Sprayed corn is more easily sold on the fresh market and brings a better price than unsprayed corn. In the canning plant worm free corn is processed at less cost than unsprayed corn.

Because of the interest by growers in the control of corn insects, increased effort is being made by Experiment Station entomologists to improve methods of application and insecticide formulations. Studies on the timing of spray applications indicate that two to four treatments are necessary and depend entirely upon the level of moth populations. In early and mid season, the first applications should be made when 25 to 50 percent of ears show silks. In late season when populations are high, first treatment should be made when 10 to 25 percent of ears are in silk. Succeeding applications should be applied at 4 to 5 day intervals. Two sprayings are sufficient early in the season, but four applications are necessary for best results on September corn, particularly if it is grown for the fresh market.

Work is also being done on insecticide formulation and dosage. Results indicate that a minimum of one and one-half pounds of actual DDT per acre is necessary and that it must be combined with mineral oil to maintain the efficiency of the treatment.

(Project H-29-j)

Experimental sprayer equipped with a row-type boom being used in studies on insect control of various vegetable crops.

VEGETABLES

Study Effect of Sprays On Pod Set of Lima Beans

Yields of Henderson and Triumph lima beans were not increased by spraying field-grown plants at full bloom with either methyl ester of naphthaleneacetic acid (MENA) or naphthalene acetamide (NA) at various concentrations. Pod set and yield were decreased by 1,000 p.p.m. MENA. Sprays of zineb and manganese sulfate, zineb and borax, zineb and magnesium sulfate, borax, or zinc sulfate at full bloom, did not affect pod set or yield.

In a subsequent experiment, sprays of 50 p.p.m. MENA applied at five different stages of growth of the Henderson lima bean did not increase yield or uniformity of maturation of the beans. Wide variations in air temperature, soil temperature or soil moisture during the blossoming period could not be associated with the yield. The use of temperature summations above 50 degrees F. was considered a better criterion of stage of development of the plants than was the number of days from planting.

In two plantings it was found that the plants dropped 89.9% of the blossoms. In these plantings there was an average of 352 blossoms per plant. Decreasing the blossom drop from 89.9% down to 86% would therefore result in a very marked increase in

Snap beans are undergoing extensive testing, with varieties, fertilizers, spacing, irrigation and insecticides receiving study. (Departments of Horticulture, Entomology and Agricultural Engineering cooperating.)

yield. Observations lead to belief that the solution to the problem may lie in inhibiting the set of pods in the early flowering cycles of the plant, resulting in greater concentration of set during later flowering cycles. (Project Q-77)

Test New Sweet Potato Varieties for Adaptability

Plant breeders over the country are continually developing new varieties of sweet potatoes. These must be carefully screened to determine their adaptability to Maryland. Three varieties have been introduced recently for Maryland farmers. Sunnyside was released jointly by the U. S. Department of Agriculture and the Maryland Agricultural Experiment Station in the spring of 1953. Nemagold (formerly Oklahoma 46) was released in the spring of 1953 by the Oklahoma Agricultural Experiment Station. Shoreland (formerly Md. 47) was released in the fall of 1953 by the Maryland Agricultural Experiment Station.

All three varieties are more resistant to root cracking than is Maryland Golden. In three years of testing, prior to release, the average yields of marketable, uncracked potatoes for the varieties were: Maryland Golden, 355 bu./A.; Sunnyside, 453 bu./A.; Nemagold, 434 bu./A.; and Shoreland, 524 bu./A.

Seed of these varieties is available from farmers in Wicomico County, Maryland, in moderate amounts.

(Projects Q-74 and L-74-a)

Southern Peas Found Adapted to Md. Conditions

At the conclusion of three years of testing of Southern Peas (edible cowpeas), certain varieties have been found adapted to Maryland conditions for canning, freezing and for home gardens. Southern peas commonly set pods over a long period of time and one of the problems involved in the harvesting of the crop for processing is the lack of concentration. In the development of new varieties in certain

"Whiptail" of cauliflower detected in a commercial field in Garrett County. Research discloses that this condition results from insufficient molybdenum in the soil.

of the southern states some emphasis has been given to the problem. A high concentration of set will permit the vines to be pulled, and the peas extracted in a commercial viner, and still have an economical yield.

Of 25 varieties tested over the three year period, three varieties were the most satisfactory in yield and in quality of the processed product. Extra Early Blackeye and Purple Hull 49 are introductions of the Texas Agricultural Experiment Station. Both types have the characteristic black-eye. Dixie Lee, introduced by the Mississippi Agricultural Experiment Station, has a brown-eye. Viner yields of these varieties may be expected to be greater than 1,400 pounds of shelled peas per acre. (Project Q-74)

New Broccoli Varieties Available for Md. Growers

Early, medium and late varieties of broccoli have been under test at the Vegetable Research Farm at Salisbury for three years. Several varieties appear to be well adapted to the Eastern Shore for fall production. In the three

years of trial, the varieties Waltham No. 29 and Early One exhibited high yields of side shoots in comparison to the terminal heads, and the frozen product was rated good to excellent. These varieties are considered best for freezing. Early Green Sprouting gave a high proportion of center heads and is considered excellent for the fresh market. Average yields in the three years for the three varieties ranged from 4,800 to 5,200 lbs. per acre of center heads and side shoots with the leaves removed. (Project Q-74)

Nitrogen and Magnesium Important For High Yields Of Cucumbers for Pickling

In a greenhouse controlled study of the effects of varying levels of nitrogen, potassium, calcium and magnesium, only limited amounts of calcium and potassium were required for satisfactory yield of cucumbers for pickling. Increasing levels of potassium did not decrease fruit yield or quality, although the yield of pickles was decreased by the highest levels of calcium chloride.

Research has revealed the above condition in cucumber leaves to be an expression of magnesium deficiency. When cucumber plants show these symptoms in the field, yields will be lower and more malformed pickles will be produced.

The most critical nutrients of those under study were nitrogen and magnesium. Fairly high levels of both of these nutrients resulted in an increased yield and in a reduction of malformed pickles. This work points to the need for possible revision of fertilizer recommendations for this crop. The recommendations may be revised, however, only after considerable field testing. (Project Q-77)

Study Sweet Potato Storage Conditions To Improve Keeping Quality

Maryland Golden sweet potatoes were stored at controlled temperatures ranging from 48 to 83 degrees F. in an effort to determine the optimum storage temperature for this variety which has been notoriously a poor keeping type. Storage at 62 degrees F. resulted in highest percentage of marketable roots after 6 months storage. Incidence of disease was greater at 55 than at 62 degree storage. Although the percentage of moisture in the roots was influenced very little by temperature or duration of storage, weight loss increased rapidly at the higher temperatures. Storage at 48 degrees resulted in internal breakdown within two months. Carbohydrate analysis showed that the starch content of the roots decreased and sugar content increased rapidly during storage at 48 and 55 degrees. At 62 degrees there was little change in the starch or sugar content during the storage period. The available carbohydrate reserves (starch plus sugars) were maintained at the highest level under 62 degree storage.

The storage behavior of 18 varieties and selections of sweet potatoes, including several recent introductions, was studied during the 1953-54 season. A number of these showed much better keeping qualities than Maryland Golden or Jersey Orange. Such a list would include Sunnyside, Allgold, Porto Rico, Kandee, and Goldrush. Nemagold was superior to Maryland Golden but exhibited storage diseases and shrinkage toward the end of the storage season. The development of an internal breakdown in the newly introduced variety Shoreland, indicates that this variety cannot be recommended for prolonged storage. (Project Q-74)

FRUITS

Develop Two Breeding Lines For Future Cantaloupe Varieties

The Experiment Station has been conducting a cantaloupe breeding program since 1949. The work to date has been concentrated upon finding new genetic material for incorporation in the types of melons desired for the market. Objectives of the program are the development of types with very high sugar content, small cavity, resistance to defoliation, hard shell, and a distinctive netting.

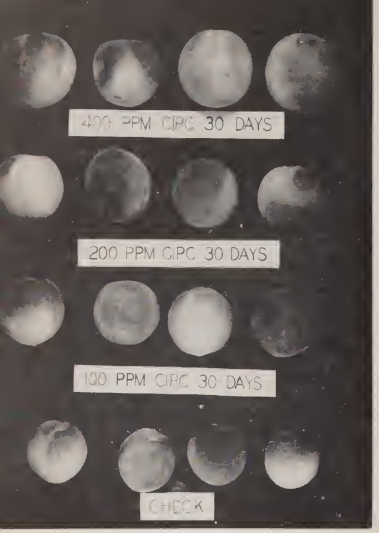
The first phases of this work are completed with the incorporation of all of the objectives into two breeding lines. The work will proceed with the crossing and back-crossing of these types to other desirable lines, accompanied by rigid plant selection. It is perhaps not too early to predict the development of new varieties in the next decade. (Project Q-81)

Chemical Thinning Sprays Increase Bloom and Yield Of "Off" Year Apple Crop

Extensive experiments in the past year with naphthalene acetamide (NAAmide) sprays for thinning of apple trees have resulted in a marked increase in the "off" year bloom and crop of fruit. All experimental trees which were adequately thinned in 1953 with chemical sprays "came back" in 1954 with a moderate to heavy bloom which ranged from 58 to 96 percent. Check trees which bloomed heavily, but were unsprayed in 1953, displayed no blossoms to a moderate amount in the spring of 1954, ranging from 0 to 64 percent. This is an added dividend which apple growers of Maryland can expect from chemical thinning sprays, provided pruning and fertilization practices are not neglected.

Satisfactory thinning was achieved in 1953 experiments on Williams, Jonathan, Transparent, Grimes, Stayman, and Delicious apples. In general,

Farmers examine cantaloupe varieties under test at Vegetable Research Farm, Salisbury.



Post-bloom sprays of organic carbamate compounds have successfully and adequately thinned peach trees in Western Maryland experiments. This photo shows chemically thinned Halehaven peaches taken at harvest time from trees which were sprayed with chloro IPC at concentrations of 100, 200, and 400 parts per million, 30 days after full bloom.

NAAmide continued to show more promising results than naphthalene acetic acid (NAAcid) which had heretofore been used. No foliage wilting accompanied any of the NAAmide sprays, and fruit size at harvest was increased directly in proportion to the amount of thinning done on the trees. For summer varieties, such as Transparent and Williams, it has been found that the thinning spray must be applied not later than 10 or 12 days after full bloom, so as to avoid ripening effects of the chemicals as the fruit matures. Concentrations of 50 parts per million (ppm) were required to adequately thin Transparents, while somewhat lower concentrations were found to be satisfactory on Williams apples. On fall and winter varieties such as Delicious, Grimes, and Stayman, later timing of the spray produced more satisfactory thinning. Application of the spray in a range of 16 to 18 days after full bloom gave more thinning than did earlier timing in the same experiments. So far, both NAAcid and NAAmide have been found to be unreliable on Rome Beauty apples, and insufficient thinning continues to result even from heavy applications of either of these chemicals.

Twenty-five organic growth regulating compounds were tested for thinning on Halehaven peaches, using a hand sprayer on individual limbs rather than a pressure sprayer on whole trees. Satisfactory thinning was achieved with three of these compounds when applied 30 days after full bloom. No injury to fruit or foliage was observed, and at harvest time, the fruits which had been thinned with these chemicals appeared normal. Full orchard experiments using these three compounds are under way in 1954 to determine, under commercial orchard conditions, the limitations under which these compounds may be used to thin peaches by means of chemical sprays.

(Project L-74-b)

PROCESSING

Statistical Quality Control New Tool in Processing

Vegetable processing plants must be operated at a high level of efficiency in order to maintain their position in a highly competitive market. Statistical quality control is a new tool which makes possible the operation of any factory line in such a way that the maximum quantity of the desired level of quality is manufactured, with only a minimum amount of loss caused by waste, or poor quality.

During the 1953 season, a complete quality control system was installed in a sweet corn processing plant on the Eastern Shore in order to study the

possibilities of such a procedure in reducing waste and improving efficiency.

One station was set up primarily for measuring the quality of the incoming product. Here the maturity and the degree of insect infestation was determined on the raw corn and charted on a control chart, so that the plant manager could note at a glance the quality of the incoming material, and take steps to insure its handling in a proper manner.

A second control station was set up at the filler bowl, where hourly tests were made for maturity, consistency, major and minor defects. These were also noted on a second quality control chart, so that any deviation from the desired quality could be corrected at once. Thus at a cost of 0.8 cents per case the plant management was provided with a continuous record of performance which insured the desired quality level at all times, eliminated unnecessary costs, and insured the pack from any possibility of seizure.

(Project Q-58-f)

Corn Syrup in Tomato Ketchup Costs Less, Prevents Color Loss

Excluding water, the major component of tomato ketchup is not tomatoes, but sugar. Anything that can be done to reduce the cost of the sugar used in the manufacture of ketchup, would reduce materially the cost of the ketchup, and enhance the value of the tomatoes used. Since corn sugar is at times less expensive, more easily available and more easily handled as a liquid component, replacement of the regular cane or beet sugar with corn syrup should reduce the cost of ketchup manufacture.

With the assistance of 11 ketchup manufacturers, 58 batches of tomato ketchup were prepared on a commercial scale in accordance with regular commercial practice, except that various percentages of the cane sugar were replaced with different types of corn syrup. Samples of these lots were tested for color and flavor at regular storage intervals up to 13 months.

The results indicated that there was no difference in flavor preference between the samples containing only cane sugar, and those containing various amounts of corn syrup; however, those samples which contained corn syrup maintained a brighter color, and developed less browning, particularly in the necks of the bottles, than did the samples containing only cane sugar. This difference in favor of corn syrup became more pronounced as the storage period was extended. (Q-58-1)

Developing Quality Standards For Frozen Asparagus and Peas

Under the regulations of the Food, Drug and Cosmetics Act, the Food and Drug Administration is required to establish when needed, standards of quality for processed foods which must be met by food processors. In recent years, it has become apparent that there is a need to establish limits of quality for fibrousness of frozen asparagus, maturity of frozen peas, and flavor of both commodities.

In cooperation with the frozen food industry and the Food and Drug Administration, work was undertaken to develop accurate, objective methods for measuring these quality factors, and to establish the quantitative levels beyond which these commodities would not be acceptable. It was found that the maturity of frozen peas could be measured most accurately by the alcohol insoluble solids test (A.I.S.), and that the minimum acceptable level was 23.6 percent A.I.S. Percent fiber content as determined by a rapid blendor method on the bottom half inch of the stalk was found to be the most satisfactory method for determining fibrousness of frozen asparagus, and the minimum acceptable level was established as 0.48 percent fiber.

Three chemical methods were studied as possible procedures for use as

mandatory standards for off-flavor; however, it was concluded that the acetaldehyde and peroxidase tests were not at all suitable, while the catalase test shows some promise, and may became satisfactory provided its accuracy in predicting off flavor can be improved.

Thus these studies were of value first in developing on a scientific basis tests for fiber and maturity, and secondly, in preventing the promulgation of flavor standards based on inaccurate tests. (Project Q-58-f)

Study Shows Possibility of More Economical Packaging For Frozen Vegetables

The package accounts for a substantial part of the total cost of frozen vegetables. Many processors use the same relatively expensive carton and overwrap for all vegetable products. It is possible, however, that certain vegetables, especially if handled and stored properly, could be packed in less expensive materials, thus reducing the overall cost of the frozen product.

Vegetables held in frozen storage tend to dessicate; thus it is essential that the carton and overwrap prevent this evaporation and consequent loss of total and drained weights, and increase in total solids.

The six types of cartons used in this study varied in quantity and method of application of a wax coating, and presence or absence of an inner cellophane liner. Some of the vegetables were not overwrapped at all, while others were overwrapped with two types of overwrap varying in wax content. The packaged vegetables were then frozen on plate freezers very rapidly, and more slowly in an air blast freezer. The frozen packages were then stored at $+5°$ F, and at $-5°$ F. Spinach, peas, corn, and broccoli were selected for use in this study as representing the four major types of vegetables.

In general, it was found that broccoli required the greatest care in handling and storage, and the most expensive packaging, while peas and corn withstood dessication best, with spinach in an intermediate position. Only the cartons with the inner cellophane liners could be used with no overwrap, and only when storage temperatures were maintained under 0° F. The other cartons required the added protection provided by an overwrap, while the cartons containing the least amount of wax were satisfactory only when used with the better overwrap and when storage temperatures were maintained below 0° F. (Project Q-58-j)

FLORICULTURE AND ORNAMENTALS

Successfully Transplant Greenhouse Roses Without Special Treatment

It becomes desirable at times to lift established rose plants in the greenhouse and replant them in order to change or improve the soil or to rebuild the beds in which they are growing. A study has been completed in which a comparison of several commercial methods of handling rose plants has been made. These included drying off (withholding of water until the leaves drop) before transplanting; lifting and placing into cold storage (40° F.) immediately for 2 to 4 weeks and combinations of these methods as well as moderate or severe pruning at the time of replanting.

It has been found that when roses must be replanted during the summer in the greenhouse that there is no benefit from drying off the plants. If possible dig the plants and replant immediately with no special treatment other than a moderate (24") pruning. This moderate pruning to 24 inches gave the greater survival of the plants than the more severe pruning of 12 inches when transplanting directly, but if the plants were placed into cold storage for a period of time, the pruning height at the time of replanting was not important. Where a period of

Poinsettias grown in soils with a low pH (4.8) were found to be less readily injured by the root rot disease as compared to those in soils less acid.

time must lapse between the time of digging and transplanting it was found that the best treatment was to dig the plants and place them into cold storage immediately in such a way that the roots were kept moist and the branches do not become dry. The time of storage should be as short as possible preferably not more than 2 weeks. The survival of plants following longer storage decreases as the storage period lengthens. (Project I-74-b)

Growing pionsettias at warmer temperatures allows the plant to produce more roots and grow in spite of attacks of the root rot disease.

Azaleas and hydrangeas being fertilized with dilute fertilizer solutions at different intervals, using different strength materials to determine exact nutrient requirements for greenhouse forcing.

Organic Materials Help Orchid Seed Germination

One of the problems in the growing of orchids is the long time that is required from the sowing of the seed until the plant is of flowering size. This is usually 5 to 7 years for most of the commercially grown genera. The accepted commercial practice is to sow the seeds on an agar medium containing inorganic mineral salts under aseptic conditions. However, even under these controlled conditions the germination and post germination growth rate are often very slow. In a study to improve this germination and growth, it has been found that the addition of fish emulsion or condiment-free tomato juice to the standard agar medium with Knudsons Solution C increases germination and growth of seedlings of the orchids, *Cattleya mossiae* and *C. skinneri*. However, when either orange juice or cottonseed meal were added they did not give the same added stimulus as did the fish emulsion or the tomato juice. The presence of the orange juice in the medium caused an inhibitory influence which may be related to the presence of sucrose or the osmotic effects of sucrose. The germination and growth response when cottonseed meal was included in the medium was suggestive of either a minor nutrient deficiency or imbalance. The additions of small amount of fish emulsion or tomato juice to the nutrient media for the germination of orchid seeds offers promise of speeding germination and the subsequent growth of the seedling. (Project I-26-a)

Hydrangea Growth Influenced by Pot Size And Fertilization

Frequent fertilization of greenhouse hydrangeas during the summer with a soluble complete fertilizer is desirable in the production of a high quality plant. A series of treatments using 15 combinations of nitrogen, phosphorous and potassium were made on the hydrangea variety Strafford. The combinations with a high amount of nitrogen and a medium amount of phosphorous and potassium were the most favorable in producing the greatest number of stems per plant with the greatest stem length during the summer as well as the most stem growth at the time of forcing and largest flowers. These combinations are best represented by a fertilizer with a 1½ - 1 - 1 ratio or a 25 - 10 - 10 fertilizer as was used in this study. In addition it was found to be more practical to grow the plants during the summer in 5 or 6 inch pots rather than in smaller sizes. A larger plant is produced and the plants are more easily cared for in the larger pots than in the smaller ones. (Project I-74-a)

Poultry

Considerable progress was achieved during the past year in the solution of problems of practical importance to poultry producers.

Breeding problems included further work in developing a flightless strain of chickens and a medium-sized strain of white turkeys noted for relatively high egg production and good hatchability. Both of these goals were achieved by progeny testing.

Some very interesting results were secured in investigations on the effects certain secretions of the endocrine glands of the fowl have on growth, molting, and egg-shell thickness.

Research in poultry nutrition covered a variety of subjects, including the effects on growth of incorporating animal fats in the diet, the place of grit in the diet of growing chickens, the effect of the quality of proteins in the diet for broilers, and the effect of several other factors on growth.

BREEDING

Working Toward Flightless Strain

Approximately six years ago, research was started toward the goal of developing a broiler type of chicken which would combine the characters of flightlessness, white color, rapid rate of growth and feathering, as well as other desirable economic characteristics. During the current year matings were continued, employing pure New Hampshire birds carrying the flightless condition as well as matings between New Hampshires and

Flightless bird on the right has no primary or secondary flight feathers.

White Leghorns. The White Leghorn-New Hampshire crosses were made for the purpose of securing from the Leghorn the gene for dominant white plumage. A total of ten individual male matings were employed and from these matings approximately 1,000 chicks were hatched. Of these birds, approximately 800 exhibited the flightless characteristic. In the matings in which one of the parents was white, approximately 50 percent of the offspring had white plumage.

Up to the time of the first molt (six to eight weeks), the chicks from the flightless stock have normal-appearing primary and secondary flight feathers. At the time of the first molt, these flight feathers are not replaced. The wings are perfectly normal and remain as appendages of balance. Egg production, fertility, and hatchability of the flightless birds are normal. The commercial possibilities of the strain have not been explored and no stock is ready for distribution.

(Purnell M-33-i)

Developing Medium Sized Turkeys With Good Reproductive Traits

Crosses have been made between turkeys of the Beltsville Small White and the Broad Breasted Bronze varieties, and selection practiced among the resulting progeny toward producing a strain of turkeys which would have good reproductive characteristics, rapid rate of growth and maturity, and white plumage color. Previous breeding work in turkeys has largely emphasized body conformation, with the all-important characteristic of reproduction largely neglected. For the turkey to compete successfully in the production of meat for human use, the replacement cost for the individual must be reduced. This can best be accomplished by improving egg production, fertility, and hatchability.

This year the number of individual tom matings used has been doubled in order to allow for greater selection pressure toward high fertility. The

Progress is being made in the development of a new strain of medium white turkeys which combine good reproductive characteristics, rapid maturity and growth rate, as well as good body conformation.

breeding stock used was selected from dam families in which the dam laid at the rate of 70 percent or better and whose eggs hatched at the rate of 70 percent or better. These figures are based upon a trapnest period ten weeks in length. Egg production in the current year has been very satisfactory and the hatchability of all eggs set from the entire flock has averaged better than 70 percent. The birds have maintained good body conformation in spite of the fact that practically all selection pressure has been directed toward improving egg production and hatchability. The strain has now been purified for white plumage.

(Purnell M-34-e)

NUTRITION

Testing Value of Feather Meal to Supply Protein in Chick Ration

In addition to the studies under way to determine the required level of total protein for broilers during the finishing period, work has been initiated to develop an improved biological chick assay suitable for studying the quality of various crude proteins. One test has been conducted comparing the value of feather meal protein with soybean meal and fish meal as sources of amino acids for the chick. In these tests, feather meal furnished digestible protein but was low in certain amino acids, particularly methionine and lysine. It appears that the protein quality of feather meal will limit its use to levels no higher than 2½ percent in chick rations. (Purnell M-35-i)

Addition of Arsanilic Acid Improves Growth Rate

In two floor-pen experiments carried to 8 weeks, the addition of 90 ppm. arsanilic acid increased the rate of growth when the ration contained adequate levels of all nutrients, including unknown factors and procaine penicillin. In one test, the feed efficiency was markedly improved, whereas no improvement was obtained in the other. (Purnell M-35-l)

Show Possibility of Using Surplus Animal Fats and Greases in Poultry Feeds

During the past year, broilers reared in batteries or under practical conditions by the University were fed surplus animal fats and greases. It was found that the use of such fats, properly stabilized with chemical antioxidants, reduced the feed required per pound of gain by approximately .1 to .2 of a pound when levels ranging from 2½ to 15 percent fat were fed. The results also reveal that when high levels of fat are used, the choline requirement of the chick is increased. Nevertheless, levels up to 5 percent fat may be added to practical feeds with no more than 700 milligrams of choline supplied per pound of feed. In all cases, however, the fats added to poultry rations should be properly stabilized by means of antioxidant materials to prevent any oxidative destruction of certain nutrients. The extent to which fats will be added to poultry feeds will depend primarily upon the relative cost of energy supplied by surplus animal fats compared with corn. (Purnell M-35-l)

Grit Not Needed When All-Mash Ration Is Fed to Broilers

The effect of free-choice feeding of insoluble grit on feed efficiency was studied in two field trials involving 16,000 broilers reared to market age. Using 4 different broiler rations, each fed as an all-mash, and as a mash concentrate—scratch grain mixture, no appreciable effect of grit feeding was observed on feed efficiency or body weight when the ration was fed as an all-mash mixture. The feeding of grit, however, during the finishing period improved the feed efficiency of broilers when cracked corn was fed as a part of the ration. The average grit consumption per thousand broilers was 449 and 406 pounds in the two experiments.

In the second experiment, an aver-

age of 9 grams of residual grit was found in the gizzard of broilers at 10 weeks of age. Despite this, there was essentially no difference between the average weight of the inedible portion of the intestinal tract between the broilers receiving grit and those receiving no grit.

The results of these experiments question the need for supplying insoluble grit when present-day all-mash broiler rations are used.

(Purnell M-35-l)

Check Value of New Chick Growth Factor

A bacterium (*Lactobacillus bifidus*) occurs in high numbers in the ceca of chicks which are not fed antibiotics. This organism, when isolated, will not grow unless an as yet unidentified growth factor is present in the basal medium. The factor is found in many plant and animal products, in yeast and certain bacterial cells (*B. subtilis, E. coli* and *A. aerogenes*) which also have been shown to stimulate the growth of chicks. Certain fractions of liver, fish solubles, whey and *E. coli*, which are potent sources of unidentified chick growth factors, have failed to support the growth of *L. bifidus*. Conversely, certain concentrates which which were about 6- to 10-fold more active for the organism than the original material failed to support chick growth to the same extent. Further work with more potent fractions is needed to prove conclusively whether or not the "*L. bifidus factor*" will promote the growth of chicks.

(Purnell M-35-k)

Study How Arsonic Compounds Promote Chick Growth Rate

A study was made of the effect of 120 ppm. of arsanilic acid on the cecal flora of 4-week-old chicks fed two types of diets, one containing casein and the other containing Drackett protein. There was an increase in the total numbers of both sporeforming and non-sporeforming aerobic and anaerobic bacteria, the increase being mainly due to gram negative organisms. The type of diet influenced greatly the kinds of predominating organisms isolated. *In vitro* tests with five arsenicals showed that, in general, reduced organic arsenicals inhibited all of the gram negative cultures, while pentavalent organic arsenicals and arsenic trioxide had variable effects, from no inhibition to complete inhibition. Arsenic compounds may influence chick growth by changing the flora to the type of bacteria which can synthesize unidentified growth factors, or by preventing the growth of undesirable bacteria. (Purnell M-35-k)

Cause and Cure Of Pullet Disease Baffles Poultrymen

Pullet disease in poultry has long baffled poultrymen and scientists. Various investigations as to the cause of the condition have met with indifferent success. Since 1929, when the condition was first reported, several treatments have been suggested which have given fairly good results, but the nature of the causative mechanism, whether it be a virus, bacterium, toxin, or dietary factor, has never been well established.

Pullet disease is found typically in layers, especially in pullets which have achieved a good rate of lay by July, August, or September. The condition has been found also in broilers and in turkeys. Mortality is rather low, and will range typically from 5 to 10 percent. In some instances, the entire flock looks sick, depressed, and without appetite, and the rate of lay declines sharply, in some flocks reaching zero. In other flocks the condition is more variable, with some birds showing sickness and others appearing to be quite normal. Darkening of combs, and loose, watery diarrhea are common.

At the Maryland Agricultural Experiment Station, investigation has

been made for a number of years of the possibility that wheat may be a contributory dietary factor, or possibly the cause of pullet disease. The investigation was started because of field results by Maryland poultrymen which seemed to incriminate wheat. In the first years of investigation at Maryland, pullets came through with a typical case of pullet disease when fed high levels of certain lots of wheat, but not when similar levels of corn were fed. On the other hand, it was found that some lots of wheat were quite incapable of producing these results. It was found that wheats which were definitely associated with pullet disease were all low in germination (below 80 percent) and contained quantities of bacteria roughly in proportion to the severity of the disease condition in the flocks.

Efforts to concentrate or isolate the factors in wheat which were causing this effect have not been a success. The objective of these attempts at isolation has been to permit a better understanding of the causative mechanism, and to reproduce the disease at will, for more precise results. Other workers have had rather similar results and it is generally considered today that the cause of pullet disease is unknown.

It is now considered that some stress factor is involved, or that the stresses of hot weather, egg production, dietary factors, disease, or other physiological conditions, contribute to its onset.

Present treatment is to use rather high levels of antibiotics in the mash—100 to 200 grams per ton. Some poultrymen have gotten good results with 1 level teaspoon of nitrate of potash to 1 gallon of water, administered for one week. Another treatment is the use of 1 pint of molasses to 4 gallons of water given for one week. The scratch grain is often omitted but extra sources of drinking water are recommended. Since the tissues of the birds show evidence of dehydration, the use of flushes is not recommended.

(Bankhead-Jones (5) M-45)

Study Vitamin K Requirements for Chicks

It was found that the addition of high levels of sulfaquinoxaline or arsanilic acid to practical-type chick rations containing no alfalfa meal increased the need for vitamin K as shown by prolonged blood clotting time. The addition of 1 percent dehydrated alfalfa or .36 milligrams of menadione (vitamin K) per pound of feed corrected the condition. It is not believed, however, that sufficiently high levels of these drugs would normally be used for a sufficient length of time to have adverse effects under usual conditions of feeding.

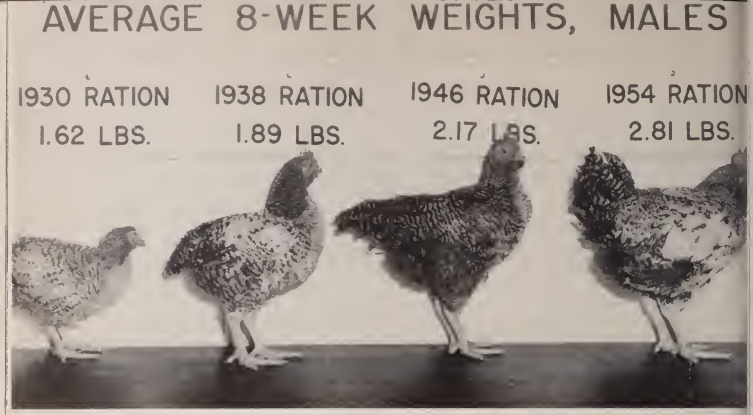
(Purnell M-35-l)

Marine Shell Deposit Found Suitable as Calcium Source for Chicks

Samples of marine shell obtained from a large deposit located at Cove Point, Calvert county, Maryland, has been tested as a source of calcium for starting chicks. In two experiments, marine shell flour from this source was found to be comparable to calcium carbonate and oyster shell flour, as measured by rate of growth, percent bone ash and blood calcium levels. This new source of calcium in the form of marine shells should prove to be very important to the poultry industry of Maryland. (Purnell M-35-l)

Tests Show Chicks Need 3 Unidentified Factors

Several tests involving chicks and poults fed purified and practical-type rations were conducted in studying new factors required for growth. The results indicate that three different unidentified factors, presumably vitamins, are required by the chick. These have been termed the "fish or liver factor," the "whey factor" and the "alfalfa factor." The multiple occurrence of these factors in various ingredients has made it difficult to develop suitable chick growth assays for measuring the response to any one of these factors. (Purnell M-35-g)



Progress in nutrition research is shown graphically by differences in weights of these New Hampshire-Barred Rock crossbreds, raised under identical conditions. The bird on the right was fed a new ration developed at this Station.

Continue Methionine Tests

Additional work directed toward determining the practical role of synthetic DL-methionine in broiler feeds has revealed that factors other than the methionine content of the ration appear to influence the response to added methionine. In comparing results obtained with 6 rations containing an average of .43 percent methionine with those obtained with 6 other rations containing an average of .37 methionine, similar responses were obtained. Additional studies are being carried out to determine whether or not free methionine has some role not normally attributed to bound methionine as it normally is found in crude proteins. (Purnell M-35-i)

PHYSIOLOGY

Hormone May Prove Useful in Regulating Molt, Egg Production

One of the most interesting observations made this year in the field of hormonal control of biological functions is the obvious effect of progesterone in initiating the growth of feather papilla. The female sex hormone, progesterone, is normally associated only with the mammalian female but has recently been demonstrated in the blood of the fowl. It was discovered that when progesterone was injected into birds that the new feathers were stimulated to grow, causing the old feathers to be shed. When laying hens were injected with progesterone, egg production ceased immediately, and within two weeks these hens were in a precipitous state of molt, then returned to full production some six to eight weeks following treatment. The subsequent egg production of the treated group was comparable with that of the controls, and the treatment seemed to have no effect on body size or egg size.

When the hens were treated with 20 mg. of progesterone, they replaced from 3 to 5 of the primary wing feathers, indicating a rather general condition of molt. It is suggested that this treatment may possibly be of use in regulating egg production or in causing prospective breeder hens to molt early in the fall so that they will be ready for spring egg production.

(Adams M-32-l)

Strains Differ in Throidal Activity

Work at the Station has previously demonstrated the possibility of developing two strains of birds differing markedly in their thyroid response to thiouracil. This difference was thought to be an indication of the activity of the anterior pituitary gland in the production of the thyroid-stimulating hormone. In spite of the wide difference observed, it was impossible to detect differences in the thyroxin secretion rates of the two strains.

The criterion for selection has been changed in an effort to have a more valid estimate of the actual thyroxin secretion rate. The method used was that of the determining the amount of protein-bound iodine in the blood stream of all prospective parents. This proves to be a more direct measurement of thyroid secretion rates and it is hoped that strains of birds differing in this character can be developed.

(Adams M-32-k)

Study Effect of Antibiotics On Blood Calcium and Thickness of Egg Shells

Further studies have been conducted investigating the effect of antibiotics in increasing blood calcium and egg-shell strength. In trials in which pullets were used, the treatment seemed to have little or no effect, which is in contrast to the observation previously reported in which penicillin increased the egg-shell thickness of eggs from yearling hens.

Because of the difficulty and expense of collecting data using hens, studies were initiated on the effect of antibiotics on the blood calcium of chicks. It was found that when terramycin, penicillin, aureomycin, bacitracin or arsanilic acid was fed to chicks at the levels of 5, 15 or 45 ppm., blood calcium was increased. It thus appears that this effect is a general antibiotic effect and not one specific for penicillin.

In subsequent trials, only penicillin was used and the dietary levels of calcium were adjusted to 0.13, 0.45, 0.72 and 1.10 percent. The low level of calcium resulted in a severe depression of growth whereas growth appeared about normal when the calcium was as high as 0.72 percent. Penicillin appeared to have no interaction with the dietary level of calcium but appeared to increase blood calcium regardless of the dietary level. Penicillin, however, did not appear to increase the deposition of calcium in the bones.

(Purnell M-33-h)

Study Effect of Hormones On Resistance to Stress

Another series of investigations was initiated to study the effect of various hormones on the resistance of chicks to stress. It is thought that the bird's resistance to muscular fatigue, as induced in a revolving cage, is probably indicative of its general well-being and perhaps indicative of its nutritional status. It was found that the thyroidal-active material, thyroprotein, increased the resistance of birds of both sexes to muscular fatigue, while thiouracil, the drug which depresses the thyroid activity, greatly decreased the resistance of the birds to fatigue. Androgen, the male sex hormone, also increased the ability of the birds to resist fatigue. This effect was somewhat more noticeable in the females than in the males. (Purnell M-33-h)

Rural Sociology

Farmers and Homemakers Surveyed on Extension Service

Three hundred and thirty-one farmers and homemakers in Cecil County were questioned concerning their participation in and knowledge of Extension Service programs and activities. Both farmers and homemakers were grouped depending on whether they were or were not directly related to Extension activities. Summarized significant similarities and differences between the two groups of farmers and homemakers are shown below:

Farmer Participants	Farmer Non-Participants
More likely to have read about farming matters	*Less likely to have read about farming matters*
More likely to have heard extension radio and TV programs	*Less likely to have heard extension radio and TV programs*
More likely to have used ideas from demonstrations	*Less likely to have used ideas from demonstrations*
More likely to have used ideas obtained in direct contact with agent	*More likely to have used ideas obtained in direct contact with agent*
More likely to have a medium-sized farm	*More likely to have a small farm*
Would include public policy in extension education	*Would include public policy in extension education*
Would help plan annual program	*Would help plan annual program*
Would demonstrate	*Would demonstrate*

Homemaker Participants	Homemaker Non-Participants
More likely to have read about homemaking matters	*Less likely to have read about homemaking matters*
More likely to have heard extension radio and TV programs	*Less likely to have heard extension radio and TV programs*
More likely to mention problems of homemaking	*Less likely to mention problems of homemaking*
More likely to have helped in 4-H	*Less likely to have helped in 4-H*
More likely had a higher level of living	*More likely had a lower level of living*
Average age—50 years	*Average age—42 years*
Would include broader subject matter in homemaking education	*Would include broader subject matter in homemaking education*
Would help plan annual program	*Would help plan annual program*
Would help in 4-H	*Would help in 4-H* (Project S-4)

Data Combined to Give Clue to Clientele of Extension Service

Data collected in Cecil county and the meetings studies were combined for a technical article titled, "On Clienteles of the Agricultural Extension Service." The data suggest that programs of the Agricultural Extension Service have at least three clienteles. The first may be called a potential clientele and includes farmers who lack orientation toward contemporary programs in agricultural education. At this point, it is believed, county workers have to personally serve this group of farmers to enhance their participation in Extension programs. The second clientele includes farmers oriented toward accepting new ideas from the county agent but their conception of a new idea may differ from an Extension worker's conception. Reference here is to the greater emphasis many of this group of farmers placed on obtaining information on soil testing, artificial breeding and herd improvement, and crop production items. The help these farmers want lies with "basic" farm practices. A third clientele includes farmers oriented toward accepting new ideas and their conception of a new idea is consistent with the Extension worker's conception. These farmers are aggressive seekers after new knowledge and techniques and are the "progressive farmers" in Extension parlance.

(Project S-4)

Farmers Interviewed on Extension Meeting as Source of Information

Ninety-eight farmers in Carroll, Frederick, and Harford counties were interviewed regarding the Extension meeting as a medium of agricultural communication. These farmers were grouped by whether or not they regularly attended Extension meetings. Attenders of Extension meetings, contrasted with non-attenders, significantly were more likely to have attended meetings of other types of organizations. Attenders more likely got farm bulletins from Extension, and non-attenders got their bulletins from commercial dealers. The two groups also differed in their opinions as to why farmers attend or do not attend Extension meetings. Attenders stated that farmers went to meetings for topics valuable to the farm business, to receive latest technical information, and to get ideas from other farmers. They thought lack of interest prompted non-attendance. Non-attenders thought that farmers attended to get the latest information, and that non-attendance occurred because they lacked farm help which would free them to attend.

(Project S-4)

Soil Conservation Research

Tobacco in Ridge Rows Yields Well; Helps Reduce Soil and Water Losses

Ridge rows have proved valuable throughout a 4-year study in reducing soil and water losses. In the work at Beltsville on a Sunnyside sandy loam soil, it was shown that, in two seasons which were unusually dry, the same yields and value of tobacco were obtained under ridge row culture and by the use of conventional methods. In two seasons with heavy rainfall the ridging gave increased yields.

Ridge row studies are being conducted on a different soil type at the University of Maryland Tobacco Experimental Farm in order to further study the adaptation of this cultural method to varying soil conditions.

Soil Type Important in Rainfall Needs of Tobacco

Studies of rainfall distribution and tobacco yields over an 11-year period indicate that soil type plays an important part in the rainfall needs for tobacco. Much past emphasis has been placed on moisture holding capacity of a soil as it affects tobacco yields. These recent studies point to additional effects of soil type that may be just as important as moisture holding capacity.

Where the subsoil is slowly permeable to water, the tobacco crop needs

Tobacco grown in ridge rows across the slope to better eliminate erosion.

from 10 to 12 inches of rainfall during the growing season to produce best yields. In these studies, rainfall in excess of this amount did not seriously reduce crop yields except in one season when extended rainfall caused plant injury.

On soils where the subsoil was more permeable, high tobacco yields tended to occur with total growing season rainfall of about 7 inches. On these same soils the lowest yields tended to occur in seasons of highest rainfall.

It is felt that the dry periods occurring between rains were the most important cause of reduction of tobacco yields on soils with slowly permeable subsoil. Reduction in yield on the soils with more permeable subsoils appears to be associated with excessive moisture conditions such as occur when rains follow one another before the ground is drained.

Small Amounts of Soil Conditioners Fail to Help Seedling Development

Reports have indicated that spraying or dusting the soil surface with small amounts of soil conditioner prevents crusting and aids in seedling establishment. Tests of cotton and sugar beet seedling emergence at Beltsville showed that crusting was the same on treated and untreated plots of a sandy loam soil. Soil conditioners applied in different ways failed to modify the adverse soil conditions on a particularly difficult site where the high cost might be justified if the soil conditioner aided in establishing cover on subsoil exposed in grading operations. From these studies, the effects of soil conditioners appear to depend as much on the type of the soil as on the amount or kind of conditioner used.

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A439 A Technique for Quickly Removing the Pituitary and Adrenal Glands of Dead Chickens. H. W. Garren. Poultry Sci. (In press).

A441 Effect of Altered Thyroidal and Gonadal Activity on Size of Endocrine Glands and Resistance to Stress in the Chick. M. H. Conner and C. S. Shaffner. (In press).

A442 Feather Pigmentation and Structural Peculiarities in a Strain of Brown Leghorns Exhibiting Symptoms of Visceral Lymphomatosis. Mary Juhn. Tenth World's Poultry Congress, Edinburgh, Scotland. (In press).

A443 The Presence of Unidentified Chick Growth Factor Activity in Dried Whey Prepared with a Minimum of Bacterial Fermentation. H. L. Jones, G. F. Combs and G. L. Romoser. Poultry Sci. (In press).

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A455 Influence of Arsanilic Acid on Dietary Requirement of Chicks for Certain Unidentified Growth Factors. G. F. Combs, G. L. Romoser and R. W. Bishop. Jour. Nutrition. (In press).

A456 Young Turkeys are More Resistant to Muscular Fatigue than Young Chickens. H. W. Garren and C. S. Shaffner. Poultry Sci. (Research Note). In press.

A460 Distribution and Properties of an Unidentified Growth Factor for Avian *Lactobacillus bifidus*. Mary S. Shorb and F. A. Veltre. Proc. Soc. Exp. Biol. and Med. 86(1): 140-145. May, 1954.

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Department of Sociology

174 Labor Use in the Eastern Shore Truck Crop Harvest. W. C. Rohrer and J. R. Motheral. (Multigraphed Circular) 34 pp. November, 1953.

196 Family Type and Social Participation: (A Study of the Relationship of Family Type to Social Participation Within the Family and in Formal Organizations in Prince George's County, Maryland). W. C. Rohrer and J. F. Schmidt. (Multigraphed Circular) 24 pp. June, 1954.

Current Projects

Agricultural Economics and Marketing

Project No.

A-18-ae Organization and Operation of Representative Types of Farms in Maryland. A. B. Hamilton and W. D. Stevenson.

A-18-ag Agricultural Productive Capacity and Efficiency. A. B. Hamilton and P. E. Nystrom.

A-18-ai Business Analysis of Southern Maryland Tobacco Farms. G. A. Stevens, A. B. Hamilton and P. E. Nystrom.

A-19-k Recent Tax Changes in Maryland and Their Effect on Farmers' Tax Obligations. P. E. Nystrom, W. P. Walker and F. E. Hulse.

A-19-m Rural Cooperative Credit. P. R. Poffenberger, W. P. Walker and R. W. Roberson.

A-19-n Economic and Security Aspects of Rural Fire Protection and Prevention in Maryland. W. P. Walker, P. R. Poffenberger and F. E. Hulse.

A-19-o Conservation and Economy in Rural Transportation of Persons, Supplies and Farm Commodities. W. P. Walker, L. C. O'Day, F. E. Hulse, E. M. Downey and C. R. Twining.

A-19-p Factors Affecting the Cost of Certain Kinds of Insurance to Farmers. W. P. Walker, P. R. Poffenberger, F. E. Hulse, I. W. Rust and C. R. Twining.

A-19-r Impact of Maryland Highway Improvement Program on Agriculture. P. E. Nystrom, W. P. Walker and F. E. Hulse.

A-26-1 Prices Paid by Farmers for Commodities Bought. P. R. Poffenberger.

A-26-ab The Marketing and Distribution of Maryland Canned Vegetables. D. J. Burns.

A-26-ae Lowering Marketing Costs: Increasing Efficiency in the Operation of Milk Receiving Processing and Distribution Facilities. G. M. Beal, C. E. Twining and F. R. Manson.

A-26-ah Marketing Maryland Forest Products. G. M. Beal and B. R. Robertson.

A-26-ai Marketing Wheat, Corn and Soyheans in Maryland. G. M. Beal, D. J. Burns and C. R. Davenport.

A-26-aj Marketing Maryland Livestock. H. D. Smith and G. M. Beal.

A-26-ak A Study of Retail Practices and Egg Quality in Baltimore, H. D. Smith, R. C. Hawes, J. B. Horne and Arnold Lundquist.

A-26-al Analysis of the Development of Farmer Cooperatives. P. R. Poffenberger and P. E. Nystrom.

A-26-am Consumer Purchases and Acceptance of Poultry Products Under Various Merchandising Practices. H. D. Smith and J. L. Crothers, Jr.

A-32-f Farm Tenancy and Leasing Arrangements in Maryland. L. B. Bohanan.
A-32-h Effect of Drainage Upon Crop Yields, Farming Practices and Land Utilization. L. B. Bohanan.
A-32-i Rural Zoning in Maryland. L. B. Bohanan.

Agricultural Education

Project No.

T-1 Possibilities of Education with Adult Farmers. R. A. Murray and A. M. Ahalt.
T-2 How Farmers Become Established. R. A. Murray and A. M. Ahalt.

Agricultural Engineering

Project No.

R-11-c Mechanization of Tobacco Production. R. W. Carpenter, G. J. Burkhardt, P. N. Winn, Jr., E. W. Martin, O. E. Street and Claude McKee.
R-11-d Tobacco Housing. R. W. Carpenter, G. J. Burkhardt, P. N. Winn, Jr., E. W. Martin, O. E. Street, Claude McKee.
R-11-e Structures and Equipment for Tobacco Stripping. R. W. Carpenter, G. J. Burkhardt, P. N. Winn, Jr., E. W. Martin, O. E. Street and Claude McKee.
R-14 Mow Curing Hay in Maryland. H. J. Hofmeister, A. V. Krewatch, G. J. Burkhardt and E. W. Martin.
R-15 Development of Equipment and Improved Methods for Harvesting Canning Tomatoes and Bush Beans. H. J. Hofmesiter, Jr., G. J. Burkhardt, L. F. George, E. W. Martin and A. Duncan.
R-17 Drying Shelled Corn with Unheated Air in Maryland. G. J. Burkhardt, H. J. Hofmeister and R. G. Rothgeb.

Agronomy

Project No.

B-43 Soybean Culture and Varietal Improvement. R. C. Leffel and G. W. Barber.
B-44 Sweet Corn Improvement. R. G. Rothgeb.
B-50 Improvement of Dent Corn. R. G. Rothgeb.
B-56-a Red Clover Improvement. A. M. Decker, Jr., T. S. Ronningen and C. H. Liden.
B-56-b Pasture Renovation Studies. A. W. Burger, T. S. Ronningen and A. O. Kuhn.
B-56-f The Evaluation of Forage Crop Varieties and Strains for their Use and Adaptatiou in Maryland. T. S. Ronningen, A. M. Decker, Jr., and A. O. Kuhn.
B-56-g Development and Maintenance of Superior Ladino Clover Breeding Material. T. S. Ronningen and A. O. Kuhn.
B-56-i Orchard Grass Breeding. T. S. Ronningen.
B-56-j Pastures for Beef Production. A. M. Decker, Jr., T. S. Ronningen, A. O. Kuhu and J. E. Foster.
B-56-k Phenological Studies in Forages. A. M. Decker, Jr., T. S. Ronningen and H. C. S. Thom.
B-56-l Variety and Strain Testing of Forage Legumes and Grasses in Maryland. T. S. Ronningen and A. M. Decker, Jr.
B-57 The Improvement, Production and Use of Rye in Maryland. R. G. Rothgeb.
B-58-a Control of Weeds in Corn. A. M. Decker, Jr., and A. O. Kuhn.
B-58-c Weed Control in Legumes. A. O. Kuhn, J. A. Meade, A. M. Decker, Jr., T. L. Bissell and M. Wilcox.
B-59 Means of Correcting Unfavorable Soil Conditions in Maryland Tobacco Plant Beds. O. E. Street, O. D. Morgan, Jr., C. G. McKee and J. E. McMurtrey, Jr.
B-60 Tobacco Fertilizer Rates and Placement in Relation to Plant Population. O. E. Street, C. G. McKee, A. O. Kuhn and J. E. McMurtrey, Jr.
B-62 Spacing Test with Maryland Tobacco. C. G. McKee, O. E. Street, and W. B. Posey.
B-64 Testing Commercially Acceptable Maryland Tobacco Varieties as Related to Quality. L. R. DeLoach and O. E. Street.
B-65 Factors Affecting Water Stability and Porosity of Soil Aggregates. E. Strickling, Bruce Beacher, Donald Bianco and Clifford Simonson.
B-66 Wheat Improvement for Maryland. R. G. Rothgeb, J. L. Newcomer, J. H. Axley and H. B. Winant.
B-67 Improvement of Small Grains for Feed. R. G. Rothgeb.
B-68 Effect of Rotational Practices Involving Various Legumes on the Growth, Quality and Composition of Maryland Tobacco. O. E. Street, G. L. Steffens, C. G. McKee, C. S. Britt and E. G. Nelson.

O-28-b A Study of the Formula and Analysis for Late Potatoes. J. H. Axley and H. B. Winant.

O-43 Crop Problems in Relation to Hydrologic Studies. R. G. Rothgeb, Mitchell Thompson and T. S. Ronningen.

O-45-b A Study of the Comparative Availability of Phosphate Materials. J. H. Axley and H. B. Winant.

O-48 Classification and Correlation of Maryland Soils with Special Emphasis on Morphology, Fertility and Conservation and Interdependence of these Factors. G. A. Bourbeau.

O-51 Alfalfa Fertility Studies. J. H. Axley, H. B. Winant, J. R. Miller and F. B. Stewart.

O-52 A Study of Soil Tests as an Index of Phosphate Availability to Plants. J. H. Axley, H. B. Winant and J. R. Miller.

O-53 Effects of Soil Physical Factors on Crop Production. E. Strickling.

O-54 Mineralogical Studies of Maryland Soils. G. A. Bourbeau and J. R. Chaves.

Agronomy—Seed Inspection

Project No.

N-7 Inspection of Seeds Sold Throughout the State. J. L. Newcomer, M. H. Day and A. O. Kuhn.

N-8 Examination of Samples from Seeds Sold Throughout the State. F. S. Holmes O. M. Kelk, E. P. Emack and A. H. Ferguson.

N-9 Examination of Samples Submitted to the Laboratory. F. S. Holmes, O. M. Kelk E. P. Emack and A. H. Ferguson.

Animal Husbandry

Project No.

C-14 A Study of the Productiveness of Purebred Beef Cattle in Maryland. W. W. Green, J. E. Foster, J. Buric and W. J. Corbett.

C-14-a Effect of Early Weaning on the Duration of Maternal Influences in Beef Calves. W. W. Green, J. Buric, J. E. Foster and W. J. Corbett.

C-14-b Type Classification as an Aid in Selection of Beef Breeding Cattle. W. W. Green, J. E. Foster and J. Buric.

C-14-c Studies on Bodily Conformation and the Correlations Between Live-Animals Measurements and the Weight and Other Characteristics of Carcasses of Wholesale Cuts in Beef Animals. W. W. Green and J. C. Corbett.

C-18 A Study of the Causes and Prevention of Bloat in Beef Cattle on Pasture. J. E. Foster, R. V. Pratt, E. C. Leffel, J. C. Shaw, A. O. Kuhn and S. P. Stabler.

C-20 The Development of Superior Lines of Swine Based on Crossbred or Purebred Foundations. W. W. Green, M. H. Kerr, J. E. Foster, J. Buric, W. J. Corbett and J. H. Zeller.

C-21 The Effect of Specific Metabolites Upon Growth Rate and General Condition of Sheep. E. C. Leffel, J. E. Foster and J. C. Shaw.

C-22 A Study of Rate of Gain and Feed Requirements of Duroc and Yorkshire Swine as Compared to Maryland No. 1. M. H. Kerr, J. E. Foster, W. L. Ensor and J. R. Sperry.

Animal Pathology

Project No.

D-46 Investigations on Brucellosis of Cattle. Cornelia M. Cotton and Gertrude-Mary Jones.

D-50 Anaplasmosis of Cattle. L. J. Poelma and Kenneth Price.

D-52 Newcastle Disease Investigations with Particular Reference to Vaccine Modifications and Virus Study. R. L. Reagan, E. C. Delaha, Sue R. Cook and A. L. Brueckner.

D-53 A Study of Rumen Fermentation and Ruminant Metabolism with Emphasis on Their Relation to Ketosis. R. B. Johnson.

D-54 Infectious Bovine Mastitis: Comparison of Different Methods of Diagnosis, Treatment, and Control in the Same Herd, Comparison of Costs and Returns. E. M. Sacchi, H. O. Lineweaver and W. A. Hook.

D-55 Investigations with Infectious Enterohepatitis (Blackhead) of Turkeys. H. M. DeVolt, L. C. Costello and A. P. Holst.

Botany

Project No.

F-12 The Native Plants of Maryland, Their Occurrence, Distribution and Economic Importance. R. G. Brown.

F-15-b Spontaneous and Induced Multiple Seedlings and Haploids of *Zea Mays Capsicum frutescens* and Other Economic Plants in Their Use in Plant Breeding. D. T. Morgan, Jr., R. D. Rappleye, J. E. Endrizzi and P. Price.

F-16 Cytological and Genetical Studies in Ornamental and Crop Plants. D. T. Morgan, Jr., R. D. Rappleye and J. E. Endrizzi.

J-78-a Breeding for Resistance to the Red Stele Disease of Strawberries Caused by *Phytophthora fragariae* Hickman and Studies Necessary to Facilitate the Development of Resistant Varieties and Other Control Measures. W. F. Jeffers, J. G. Kantzes and D. H. Scott.

J-86-a The Nature and Control of Sweet Potato Diseases Occurring in Maryland, Including Studies on Significance of Microbiological Antagonism. W. F. Jeffers, C. E. Cox, J. G. Kantzes, J. P. Martin and H. W. Gilbertson.

J-88 Development of Identification and Control Procedures for Plant Virus Diseases in Maryland. O. D. Morgan, W. F. Jeffers, L. O. Weaver, J. R. Keller, O. E. Street, E. E. Clayton and E. G. Beinhart.

J-89 Development of Improved Strains of Maryland Tobacco Resistant to Diseases. O. D. Morgan, O. E. Street and E. E. Clayton.

J-90 Adaptability of Disease Resistant Varieties of Potatoes to Maryland. C. E. Cox, J. G. Kantzes and L. O. Weaver.

J-91 Evaluation of Fungicides for the Control of Diseases of Vegetable Crops. C. E. Cox, H. D. Sisler, J. G. Kantzes, L. O. Weaver, P. E. Hochstein, N. L. Marshall, L. P. Ditman and B. C. Smale.

K-8-b A Determination of the Concentrations of Various Inorganic and Organic Components Coincident with Maximal Yields of Certain Crop Plants in Maryland. H. G. Gauch and W. M. Dugger, Jr.

K-8-c The Role of Trace Elements in Plant Nutrition. H. G. Gauch, W. M. Dugger, Jr., Edward Sisler and James Baker.

Dairy Husbandry

Project No.

G-34 Chemical Changes in Milk Fat as Related to the Flavor of the Milk. M. Keeney, Richard Bassette, William Gasser.

G-35 The Analysis of Dairy Products. M. Keeney, W. S. Arbuckle and E. A. Corbin.

G-37 Ketosis and Parturient Paresis in Dairy Cows. J. C. Shaw, G. H. Beck, J. Gilbert, D. E. Jacobson, A. C. Chung, R. A. Gessert, W. M. Gill, J. A. Speicher and D. M. Oreamuno.

G-38 The Physiology of Milk Secretion. J. C. Shaw, G. H. Beck, R. E. Brown and W. L. Ensor.

G-39 Factors That Affect the Availability of Nutrients in Feeds and Their Influence Upon Blood Composition and Milk Secretion. J. C. Shaw, G. H. Beck, R. E. Brown, J. A. Speicher, R. A. Gessert, H. M. Irvin and R. N. Doetsch.

G-40 The Influence of High Temperature Heat Treatment on Certain Physical and Chemical Properties of Milk. M. Keeney and I. D. Rifaat.

G-42 Methods of Processing and Other Factors Affecting the Quality of Ice Cream. W. S. Arbuckle, L. F. Cremers and D. J. Seely.

G-43 The Metaholism of Acetate, B-hydroxybutyric Acid, Glucose and Other Carbon Compounds in Lactating Ruminants. J. C. Sbaw, G. H. Beck, S. Lakshmanan, S. Kumar, D. E. Jacobson, and D. M. Oreamuno.

G-44 The Effect of the Farm Holding Tank Milk Procurement System Upon the Keeping Quality of Milk. J. S. Conrad, J. F. Mattick and W. S. Arbuckle.

Entomology

Project No.

H-29-g Insecticidal Control of the Mexican Bean Beetle. L. P. Ditman and E. N. Cory.

H-29-i The Relation of Control of Cucumber Insects to Yield of Quality Pickles. L. P. Ditman, C. E. Cox, F. C. Stark and G. J. Burkhardt.

H-29-j Chemical Control of the Corn Earworm. L. P. Ditman, F. P. Harrison, G. J. Burkbardt, A. Kramer and H. S. Todd.

H-29-k The Drosophila Problem in the Canning of Tomatoes. L. P. Ditman, and W. E. Bickley.

H-35-a Nursery Insects. The Euonymus Scale. H. A. Highland and E. N. Cory.
H-35-b Control of the Boxwood Psyllid *Psylla Buxi* (L.). E. N. Cory, J. R. Foster and H. A. Highland.
H-35-c Pests of Holly. E. N. Cory and H. A. Highland.
H-40 Biology and Control of Tobacco Insects. Sub. 1. The Tobacco Horn Worms. H. S. McConnell.
H-43 The Biology and Control of the European Corn Borer Under Maryland Conditions. H. S. McConnell.
H-46-c Liquefied Gas Propelled Sprays for the Home Gardener. L. P. Ditman, H. S. Todd and A. Kramer.
H-46-d Studies on the Efficiency of Fixed Boom Low Volume Sprayers. L. P. Ditman, G. J. Burkhardt, F. C. Stark, C. Reynolds, H. S. Todd and C. E. Cox.
H-48 The Codling Moth. E. N. Cory, C. Graham and B. Cochran.
H-50 The Biology and Control of the Pests of Commercial Floriculture. E. N. Cory and E. E. Haviland.
H-50-a The Control of Orchid Pests. E. N. Cory.
H-55 Control of Peach Insects. E. N. Cory and C. Graham.
H-56 Patuxent Project on the Effect of Soil Conservation Upon Insect Populations. H. B. Owens, E. N. Cory and L. P. Ditman.
H-58 A Taxonomic Study of the Coccid genus *Toumeyella* and Some Closely Related Genera. H. S. McConnell.
H-59 Bionomics of Some Freshwater *Aedes* Mosquitoes in Maryland. W. E. Bickley.
H-60 Biology and Control of Nut Weevils. W. T. Johnson and E. N. Cory.
H-61 The Biology and Distribution of *Macropsis Trimaculata* Fitch. E. N. Cory, C. Graham and B. Cochran.

Home Economics

Project No.

Y-1 The Utilization of Protein by Normal College Women. Pela Brauscher, H. Nilson, H. A. Bishop, Marie Mount and I. C. Haut.

Horticulture

Project No.

I-26-a Rooting of Ornamental Plants Difficult to Propagate.
I-74-a Effect of Environmental Factors and Cultural Practices on the Growth and Flowering of Hydrangeas and Azaleas. J. B. Shanks and C. B. Link.
I-74-b Effect of Environmental Factors and Cultural Practices on Growth and Flowering of Greenhouse Cut Flower Crops. C. B. Link and J. B. Shanks.
I-79-h The Relationship of the Mineral Nutrients and Nutrient Levels to the Growth and Flowering of the Azalea Under Greenhouse Conditions. C. B. Link and J. B. Shanks.
I-79-i The Balance and Intensity of Inorganic Nutrient Elements as they Affect the Growth, Flowering and Quality of *Hydrangea macrophylla* Thunb. under Greenhouse Conditions. J. B. Shanks and C. B. Link.
L-73 Adaptation of Fruit Varieties and New Seedlings to Maryland. I. C. Haut and F. Lawrence.
L-74 Environmental Factors and Cultural Practices in Relation to the Growth and Fruiting Responses of Fruits. A. H. Thompson, F. J. Lawrence and I. C. Haut.
L-74-a Relation of Environmental and Soil Factors to the Cracking of Sweet Potatoes. L. E. Scott, F. C. Stark, W. L. Ogle, W. A. Matthews and A. A. El-Kattan.
L-74-b Chemical Thinning of Apples and Peaches. A. H. Thompson, E. A. Stahly and C. O. Dunbar.
L-79-a Mineral Nutrition of the Strawberry with Particular Reference to Effects of Calcium, Potassium and Magnesium on Growth and Fruiting. L. E. Scott, I. C. Haut, Ralph Ruppenthal and Virginia France.
Q-58-f Develop Objective and Easily Applied Measures of Quality Factors Involved in Market Grades and Standards. N. Elehwani, I. C. Haut, A. Kornetsky, A. Kramer, L. E. Scott, Eugenia Sokolov, H. S. Todd, B. A. Twigg and V. H. Nicholson.
Q-58-i Improvement of Quality of Processed Tomatoes and Tomato Products. A. Kramer, F. C. Stark, S. H. Todd, W. L. Ogle and Eugenia Sokolov.
Q-58-j Suitability of Various Materials for Use as Containers for Frozen Vegetables. A. Kramer, Eugenia Sokolov and N. Elehwany.
Q-58-k Development for Specifications for Canned Food Quality. A. Kramer, F. C. Stark and R. C. Wiley.
Q-58-l The Effect of Corn Syrup Upon the Color of Tomato Ketchup. W. L. Ogle, Eugenia Sokolov and A. Kramer.

Q-58-m Flavor Evaluations by Taste Test Panel Methods. A. Kramer, R. C. Wiley, F. C. Stark, L. E. Scott and L. P. Ditman.

Q-58-n Suitability of New Varieties of Horticultural Crops for Canning and Freezing. B. A. Twigg, W. A. Matthews, H. S. Todd, F. C. Stark and A. Kramer.

Q-74 A Study of Regional Adaptation of Certain Vegetable Crops and Varieties in Maryland. F. C. Stark, A. A. Duncan, W. A. Matthews, A. Kramer and B. A. Twigg.

Q-77 Crop Management Studies with Vegetable Crops. F. C. Stark, C. W. Reynolds, A. A. Duncan and W. A. Matthews.

Q-79-b The Mineral Levels and Interrelationships of Mineral Nutrients in Fruit Plantings in Maryland. L. E. Scott, A. H. Thompson, C. O. Dunbar, John Popenoe, Virginia France and Shawky Maximos.

Q-79-c Influence of Nutrient Intensity and Balance on the Quality and Physiological Defoliation of Cantaloupes. F. C. Stark, W. A. Matthews, C. W. Reynolds and S. H. Todd.

Q-79-d Causal Factors and Control of "Diehack" of Asparagus. L. E. Scott and Virginia France.

Q-79-e Influence of Nutrient Intensity and Balance Upon the Yield and Quality of Tomatoes. F. C. Stark, A. Kramer, W. A. Matthews, C. W. Reynolds and S. H. Todd.

Q-79-f Mineral Nutrition of the Sweet Potato with Special Reference to Cation Interrelationships. L. E. Scott and F. C. Stark.

Q-81 Cantaloupe Breeding and Selection with Particular Reference to Quality and Resistance to Defoliation. F. C. Stark.

Q-82 Tomato Breeding and Selection with Particular Reference to Greater Resistance to Cracking and to Late Blight. F. C. Stark.

Poultry Husbandry

Project No.

M-32-k Difference in Thyroid Activity as Related to Strain Differences in Growth, Feed Utilization and Feathering. C. S. Shaffner and H. L. Bumgardner.

M-33-h Hormonal Control of Economic Traits in Poultry. C. S. Shaffner, D. W. Francis and P. Bogdonoff.

M-33-i Development of a Flightless Strain of New Hampshire Chickens. C. S. Shaffner and M. A. Jull.

M-33-j Semen Studies with Chickens and Turkeys. C. S. Shaffner and P. Bogdonoff.

M-33-k Strain Comparisons for Broiler Production. C. S. Shaffner and M. A. Jull.

M-34-e Medium Sized Strain of Turkeys with Certain Desirable Qualities. C. S. Shaffner and M. A. Jull.

M-35-g The Requirements of the Growing Chick for Newer Members of the Vitamin B Complex. G. F. Combs, G. L. Romoser, G. B. Sweet, H. L. Jones and R. W. Bishop.

M-35-i Amino Acids in Poultry Nutrition. G. F. Combs, G. L. Romoser and R. W. Bishop.

M-35-k Unidentified Growth Factors for Chickens and Bacteria. Mary Shorb, G. L. Romoser, F. A. Veltre, Maye Hansen, Dorothy D. Sowter and C. R. Brown.

M-35-l Development of Improved Rations and Feeding Methods for Broiler Production. G. F. Combs, G. L. Romoser, William Donaldson, R. W. Bishop, J. Nicholson and G. B. Sweet.

M-45 New Studies on the Causative Effects of Wheat in Pullet Disease. G. D. Quigley and H. M. DeVolt.

Sociology

Project No.

S-2 Some Characteristics of the Family in Prince George's County, Maryland, A Study in the Rural Urban Fringe. H. C. Hoffsommer, W. C. Rohrer and J. F. Schmidt.

S-4 Studies in Social Organization with Application to Maryland Agricultural Extension Service. H. C. Hoffsommer, W. C. Rohrer and Kenneth Combs.

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G. Rothgeb, Ph.D., Res. Prof Crops
E. Street, Ph.D., Assoc. Prof. Tobacco
W. Strickling, Ph.D., Asst. Prof. Soils
C. Tso, Ph.D., Res. Assoc. (Coop. U.S.D.A.)
B. Winant, M.S., Res. Asst. Prof. Soils

IMAL HUSBANDRY

E. Foster, Ph.D., Prof. and Head of Dept.
m Burle, M.S., Asst. Prof. An. Husb.
W. Green, Ph.D., Prof. An. Husb.
H. Kerr, M.S., Assoc. Prof. An. Husb.
C. Leffel, Ph.D., Asst. Prof. An. Husb.

IMAL PATHOLOGY

L. Brueckner, B.S., D.V.M., Prof. and Head of Dept.
rnelia M. Cotton, Ph.D., Agt. (Coop. U.S.D.A.)
M. DeVolt, D.V.M., M.S., Prof. Path.
B. Johnson, A.B., Prof. Vet. Physiology
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O. D. Morgan, Ph.D., Asst. Prof. Botany
R. D. Rappleye, Ph.D., Asst. Prof. Botany
L. O. Weaver, Ph.D., Prof. Plant Path.

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W. S. Arbuckle, Ph.D., Prof. Dairy Mfg.
R. E. Brown, M.S., Instr. Dairy Husb.
J. S. Conrad, B.S., Asst. Inspr. Dairy Husb.
R. A. Gessert, D.V.M., Res. Assoc. Dairy Husb.
Mark Keeney, Ph.D., Asst. Prof. Dairy Mfg.
J. F. Mattick, Ph.D., Asst. Prof. Dairy Mfg.
J. C. Shaw, Ph.D., Prof. Dairy Husb.

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Castillo Graham, Ph.D., Assoc. Prof. Ent.
H. S. McConnell, M.S., Assoc. Prof. Ent.

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H. I. Brigham, Jr., M.S., Res. Asst.
D. M. Britton, Ph.D., Asst. Prof. Pomology
A. A. El-Kattan, Ph.D., Asst. Prof. Hort. Processing
L. J. Enright, Ph.D., Asst. Prof. Ornamental Hort.
A. Kramer, Ph.D., Prof. Hort.
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C. B. Link, Ph.D., Prof. Flor.
W. A. Matthews, M.S., Assoc. Prof. Veg. Crops
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C. W. Reynolds, Ph.D., Asst. Prof. Veg. Crops
R. U. Ruppenthal, B.S., Res. Asst.
L. E. Scott, Ph.D., Prof. Hort. Phys
J. B. Shanks, Ph.D., Assoc. Prof. Flor.
F. C. Stark, Jr., Ph.D., Prof. Veg. Crops
A. H. Thompson, Ph.D., Prof. of Pomol.
S. H. Todd, B.S., Instr. Hort.
R. C. Wiley, Ph.D., Asst. Prof. Hort. Processing

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R. W. Bishop, M.S., Res. Asst. Poultry Nut.
G. F. Combs, Ph.D., Prof. Poultry Nut.
Mary Juhn, Ph.D., Res. Prof. Poultry Phys.
G. D. Quigley, B.S., Assoc. Prof. Poultry Husb.
G. L. Romoser, Ph.D., Asst. Prof. Poultry Nut.
C. S. Shaffner, Ph.D., Prof. Poultry Phys.
Mary S. Shorh, Ph.D., Prof. Poultry Nut.

SEED INSPECTION

F. S. Holmes, M.S., Chief Seed Inspector

SOCIOLOGY

W. C. Rohrer, M.S., Asst. Prof.

Changes In Personnel

POINTMENTS

H. Beck, Ph.D., Prof. and Head of Dept., Dairy Husbandry, September 5, 1953
W. Bishop, M.S., Research Assistant, Poultry, July 1, 1953
M. Britton, Ph.D., Assistant Professor, Horticulture, January 15, 1954
A. El-Kattan, Ph.D., Assistant Professor, Horticulture, January 25, 1954
A. Gessert, D.V.M., Research Associate, Dairy Husbandry, September 1, 1953
W. Reynolds, Ph.D., Assistant Professor, Horticulture, December 15, 1953
L. Romoser, Ph.D., Assistant Professor, Poultry, September 1, 1953
C. Wiley, Ph.D., Assistant Professor, Horticulture, August 1, 1953

SIGNATIONS

W. Pou, Ph.D., Prof. and Head of Dept., Dairy Husbandry, July 10, 1953
L. Ogle, Ph.D., Assistant Professor, Horticulture, January 31, 1954

Financial Statement — July 1, 1953 to June 30, 1954

FEDERAL FUNDS

	Hatch	Adams	Purnell	Bankhead - Jones				
				5	9b-1-9b-2	9b3	Title II	
Appropriation 1953-1954	$15,000.00	$15,000.00	$60,000.00	$36,488.62	$588.15 $55,070.86	$19,350.00	$11,000.00	
Totals	15,000.00	15,000.00	60,000.00	36,488.62	55,659.01	19,350.00	11,000.00	
Receipts from sources other than Federal 1953-54								**For Agr. Investigations***
State Appropriations for Agricultural Investigations								$459,352.98
Foundations and Industrial Grants								85,580.65
Sales and Miscellaneous								137,007.71
								$681,941.34
Balance brought forward July 1, 1953								111,579.51
Total								$793,520.85
Expenditures:								
Personal Services	10,870.00	12,200.00	47,256.19	26,636.38	36,117.11	10,436.59	7,274.64	444,718.94
Travel	1,381.06	25.10	1,784.50	471.28	2,094.15	1,355.31	3,432.75	14,577.07
Transportation	4.34	4.46	29.68	127.58		30.76		655.59
Communication Service	36.97		67.67	90.49	81.88	72.92		2,109.13
Rents and Utility Services	695.13		96.16	67.75	128.77	82.96		5,847.88
Printing and Reproduction	353.78		489.23	37.10	79.52	434.15	200.00	3,401.86
Other Contractual Services	508.34	112.21	328.09	401.95	1,949.43	574.39	40.00	26,314.50
Supplies and Materials	727.07	2,335.59	8,929.35	7,515.40	9,170.43	4,958.71	36.79	153,072.45
Equipment	423.31	322.64	909.10	1,140.69	5,933.31	841.59		39,401.43
Lands and Structures			109.91		104.41			8,226.29
Contributions to Retirement								
	$15,000.00	$15,000.00	$59,999.88	$36,488.62	$55,659.01	$18,787.38	$10,984.18	$698,325.14
Balance June 30, 1954			.12			562.62	15.82	95,195.71
Totals	$15,000.00	$15,000.00	$60,000.00	$36,488.62	$55,659.01	$19,350.00	$11,000.00	$793,520.85

*Including Bankhead-Jones Offset Funds.

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